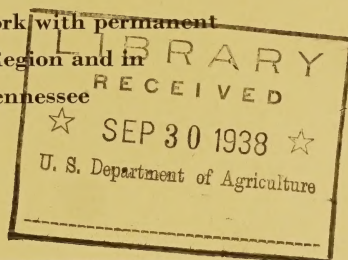


PERMANENT PASTURES

A compilation of experimental work with permanent
pastures in the Southern Region and in
North Carolina and Tennessee



UNITED STATES DEPARTMENT OF AGRICULTURE

Agricultural Adjustment Administration

Washington, D. C.

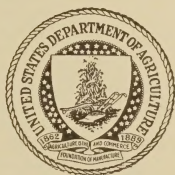
Southern Region Agricultural Conservation

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL ADJUSTMENT ADMINISTRATION
WASHINGTON, D. C.

SOUTHERN REGION AGRICULTURAL CONSERVATION

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Issued in the Interest of Agricultural Conservation by the Agricultural
Adjustment Administration of the United States Department
of Agriculture in Conjunction with the State Agricultural
Colleges of the Southern Region and of North
Carolina and Tennessee



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INTRODUCTION

In an effort to determine the actual value of permanent pastures under conditions applicable to the Southern Region, a thorough examination has been made of the available records of agricultural experiment station work in this field. In making this compilation a review was made of all permanent pasture experiments reported to date by the agricultural experiment stations of the States included in the Southern Region (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, South Carolina, and Texas), and of North Carolina and Tennessee.

This material has been abstracted and compiled in a concise form intended to make it easy for the reader to see at a glance the results of these experiments. No interpretations of the data have been attempted.

The results have been grouped under the four general headings of Value, Establishment, Improvement, and Management, so that all the experiments applicable to each of these problems can be found in the same section of the bulletin. Overlapping of material from one group to another has been pointed out in footnotes throughout the text. The digests have been arranged alphabetically, by States, under each subdivision.

Some of the experiments give results in terms of animal gains or milk yields. All of these compare pasture alone with pasture plus one or more kinds of supplementary feed. The others give results in terms of grass yields. Except for the experiments which show the relative value of individual grasses, these compare an untreated pasture or check plot with treated areas.

All the material included in this compilation has been checked by the staffs of the various experiment stations concerned, and has been approved by them for publication.

PERMANENT PASTURES

Comparative Value of Pasture and Pasture Plus Supplementary Feed ¹

ALABAMA

EXPERIMENT A

Conducted jointly by: The Bureau of Animal Industry of the United States Department of Agriculture and the Alabama Agricultural Experiment Station, Auburn, with the cooperation of Mr. O. E. Cobb and Mr. McMillian.

Conducted at: Sumterville, on the farms of Mr. O. E. Cobb and Mr. McMillian in 1908 and 1909, and on the farm of Mr. Cobb from 1910 to 1913, inclusive.

Period: 1908-13.

Purpose: To study methods of (1) wintering mature steers and (2) fattening the same steers on pasture the following summer. Only results secured in the summer phase are reported here.

Soil: The soil of the pastures on Mr. Cobb's farm was of three types. The rolling land, some of which was rather rough and gullied, was Houston clay, usually termed "lime-hill prairie land." The slightly rolling land between the hills and creek was a reddish sandy loam of Orangeburg clay. Level stretches near the creek were Waverly loam, and consisted of a fertile deposition of silt and clay from flood waters. This area was sometimes rather wet. All the soils on Mr. Cobb's farm contained considerable lime. The land was typical of that in the prairie sections, or "Black Belt," of Alabama and Mississippi.

Procedure and conditions: The pastures consisted of a mixture of sweetclover, lespedeza, Johnson grass, crabgrass, and some Bermuda grass. The sweetclover had been planted but the other plants were volunteer. The land was divided into two pastures (a third pasture is not included in this digest), the size of each depending upon the number of cattle grazed on it and upon whether or not the steers were to be fed a concentrate supplement. The object was to have an abundance of pasture for each lot of cattle.

The steers used from 1908-11, inclusive, were in each case purchased the previous fall in Sumter, Wilcox, Marengo, and neighboring counties. They were grade Aberdeen Angus, Shorthorn, Hereford, and Red Polled, many having a predominance of Jersey and scrub breeding. The steers used in 1910 and 1911 were of poorer quality and smaller size; many of them were a cross between purebreds and scrubs, others having a predominance of scrub blood. In the spring when placed on pasture, the animals were strong and active, and in good grazing condition.

¹ See also table No. 18.

Most of the steers used in 1912 and 1913 were purchased in the spring. They were chiefly grade Hereford, Shorthorn, and Aberdeen Angus with a few grade Red Polled, and some which showed Jersey blood. All were of fair quality and in thrifty condition.

All the cattle were typical of those raised in Alabama and ranged from 2 to 4 years in age. Each spring the cattle were divided into lots before being placed on pasture. They were salted at regular intervals and weighed, as a rule, every 28 days. Good shade trees were the only shelter.

Lots which received supplementary feed were fed once a day. Movable feed troughs were used so that the manure would be distributed over the field. Cottonseed cake was nut size, and in 1910 it was not of the best quality. Steers were started on a small amount of feed and the ration was gradually increased. The steers used in 1913 had been fed cottonseed cake lightly for about 5 weeks before the test.

The cattle were not grazed through the entire season but through the best portion of the grazing season. They were sold in August and September.

Miscellaneous: Two other lots (C and D) have not been included in this report because they were not strictly comparable from the standpoint of cattle grade or of the feed which they received.

Dipping kept down heavy infestation of ticks. Four cases of Texas fever occurred during the first 2 years, but no cattle were lost.

In 1913 rains were frequent except for a short dry period early in May.

Results: Given in table 1.

TABLE 1.—*Gains made by steers on pasture only and on pasture plus supplementary feed, Sumterville, Ala., 1908-13*

Item	1908		1909		1910		1911		1912		1913		6-year average ¹	
	Pasture	Pasture plus cotton-seed cake	Pasture	Pasture plus cotton-seed cake	Pasture	Pasture plus cotton-seed cake	Pasture	Pasture plus cotton-seed cake	Pasture	Pasture plus cotton-seed cake	Pasture	Pasture plus cotton-seed cake	Pasture	Pasture plus cotton-seed cake
Steers.....number.....	26	26	40	75	25	34	25	25	29	36	26	26	28	37
Days grazed.....do.....	112	112	154	154	118	118	141	141	112	101	147	147	131	129
Average initial weight per steer.....pounds.....	732	739	647	639	544	576	563	565	646	611	610	593	624	620
Average gain per steer.....do.....	170	250	268	290	193	233	247	240	117	129	240	309	206	244
Total feed consumed per steer.....do.....	---	371	---	524	---	411	---	505	---	1360	---	1544	---	452
Sale price per 100 pounds.....dollars.....	3.66	4.53	3.79	4.57	3.50	4.25	3.50	4.50	4.00	4.75	5.00	6.00	3.91	4.73

¹ Calculated by the Southern Division, A. A. A.

GRAY, D. T., and WARD, W. F. 1. Wintering steers in Alabama. 2. Fattening cattle on pasture in Alabama. Ala. Agr. Expt. Sta. Bul. 151, pp. 27-63, illus. 1910. See pp. 31-36, 48-51, 53, 57, 58.

GRAY, D. T., and WARD, W. F. Fattening cattle in Alabama. U. S. Dept. Agr. Bul. 110, 41 pp., illus. 1914. See pp. 14-19, 21.

WARD, W. F., and GRAY, D. T. Fattening steers on summer pasture in the South. U. S. Dept. Agr. Bul. 777, 24 pp., illus. 1919. See pp. 1-5, 8, 9.

EXPERIMENT B

Conducted by: Alabama Agricultural Experiment Station, Auburn, in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture and Mr. F. I. Derby.

Conducted at: Sumter County, on the farm of Mr. Derby.
Period: 1909-10.

Purpose: To compare pasture alone with pasture plus cottonseed cake for fattening scrub steers during the summer. Other phases of the experiment, which are not reported here, included wintering these scrub steers and wintering and summering excellent grade steers.

Soil: The soil was of a sandy and sandy-loam character, such as is found in cut-over pine districts.

Procedure and conditions: Two similar pastures were used, one for each lot of cattle. The pasture plants were carpet grass, lespe-deza, broomsedge, and a small amount of Bermuda grass and *Paspalum (P. dilatatum)*. They afforded an abundance of grass throughout the grazing season, but the ground was low, and the growth was rank and very watery because of frequent rains. No money or time had ever been expended on these pastures except to build a wire fence around them. The plants had come voluntarily after the pine woods were cleared away.

Three- to four-year-old scrub cattle were purchased in the fall of 1909, in Sumter and neighboring counties. From December 6, 1909, to April 23, 1910, they were roughed on range alone, making an average gain of 10 pounds per head.

On April 23, 1910, the cattle were divided into two lots as nearly equal as possible in quality, size, and breeding, and placed upon separate pastures. Cottonseed cake was given as a supplementary feed to the animals in one lot, while the other lot received no supplementary feed. Cattle were removed from the pastures on September 2, 1910.

The cottonseed cake had been broken into nut size by the oil mill, and sacked. Cattle were fed each day, about sundown, from an open trough located conveniently in the pasture. Steers were started on a small amount of feed and the amount was gradually increased as they became accustomed to it.

There were plenty of good shade trees in the pastures. No other shelter was provided. Salt and water were available at all times.

The total weight of each lot was taken every 28 days, and at the beginning and end of the tests.

TABLE 2.—*Summer fattening of scrub steers on pasture only and on pasture plus cottonseed cake, Sumter County, Ala., 1910*

Item	Pasture alone	Pasture plus cottonseed cake
Steers.....number.....	15	28
Days grazed.....do.....	132	132
Average initial weight per steer.....pounds.....	580	572
Average gain per steer.....do.....	177	189
Total cottonseed cake per steer.....do.....		2518
Sale price per 100 pounds.....dollars.....	3.60	3.88

¹ Calculated by Southern Division, A. A. A. Bulletin 163 gives the number of days from Apr. 23 to Sept. 2, 1910, as 113 days.

² Calculated by the Southern Division, A. A. A.

CRAY, D. T., and WARD, W. F. Steer feeding in Alabama. Ala. Agr. Expt. Sta. Bul. 163, pp. 59-133, illus. 1911. See pp. 78-83, 88-95.

Miscellaneous: Although there were cattle ticks in the pasture, heavy infestation was prevented by dipping. No cases of Texas fever developed.

Results: Given in table 2.

EXPERIMENT C

Conducted by: Alabama Agricultural Experiment Station, Auburn.

Conducted at: Kirkwood Plantation, Faunsdale, Marengo County.

Period: 1927-32.

Purpose: To compare pasture alone with pasture plus cottonseed meal in fattening steers for the July market; and to compare these steers with those fattened on pasture alone for the September market.

Land history: The land had been cleared probably for more than 40 years prior to this experiment. It had been in permanent pasture for years and had received no fertilizer.

Soil: The soil was a mixture of three types, Sumter, Bell, and Houston. The land was rolling.

TABLE 3.—Gains made by steers fattened on pasture only and on pasture plus cottonseed meal for the July market, and by steers fattened on pasture for the September market, Faunsdale, Ala., 1927-32

Lot No.	Ration and month sold	Date	Steers	Days on pasture	Average initial weight	Total gain per steer	Total cottonseed meal per steer ¹	Sale price per 100 pounds
		Year	Number	Number	Pounds	Pounds	Pounds	Dollars
1-----	Pasture and cottonseed meal. Steers sold in July	1927	10	70	527	177	331	7.53
		1928	10	70	633	181	336	10.25
		1929	14	91	561	224	364	11.00
		1930	26	77	568	202	410	8.25
		1931	20	96	654	240	480	5.88
		1932	25	98	659	209	418	5.60
2-----	Pasture only. Steers sold in July	1927	10	70	526	119	0	6.61
		1928	10	70	630	178	0	10.25
		1929	14	91	560	147	0	10.50
		1930	26	77	562	183	0	7.25
		1931	10	96	663	202	0	5.25
		1932	26	98	661	115	0	4.75
3 ² -----	Pasture only. Steers sold in September.	1930	19	169	556	288	0	7.00
		1931	10	147	663	269	0	6.17
		1932	26	147	661	218	0	4.52
1-----	6-year average, 1927-32		18	84	600	205	390	8.08
2-----	do.		16	84	600	157	0	7.43
1-----	3-year average, 1930-32		24	90	627	217	436	6.58
2-----	do.		21	90	629	167	0	5.75
3-----	do.		18	154	627	258	0	5.90

¹ Calculated by the Southern Division, A. A. A.

² Lot 3 was added to the experiment in 1930.

GRIMES, J. C., SEWELL, W. E., and COTTIER, G. J. Cottonseed meal as a supplement to pasture for fattening steers in the Black Belt of Alabama. Ala. Agr. Expt. Sta. Cir. 72, 11 pp. 1935. See pp. 4-6, 8, 9. GRIMES, J. C., Head, Anim. Indus. Group, Ala. Agri. Expt. Sta., Auburn, Ala. Correspondence of May 20, 1937.

Procedure and conditions: Each lot of steers was turned into a large Black Belt pasture which was sufficient to provide unlimited

grazing at all times. The pastures were composed mostly of black medic, Dallis grass, Johnson grass, white clover, and Bermuda grass. All grasses were volunteer.

The steers used in this experiment averaged 18 to 24 months in age, and were high-grade Herefords which had been raised on the Kirkwood plantation or on adjoining farms in the community. They were strong and thrifty at the beginning of the experiment and were given no special treatment in preparation for it. All steers were weighed individually on 3 consecutive days both at the beginning and at the close of the experiment. The averages of the three weights were taken as the initial and the final weight, respectively. Trees were the only shelter provided.

Steers in lot 1 received, in addition to the pasture, an average daily allowance of 4.69 pounds of 7-percent cottonseed meal per head, fed once daily in an open manger. Steers in lot 2 (check lot) and lot 3 received no supplementary feeds.

Lot 3 was added to the experiment in the spring of 1930. The steers in this group were sold in September, while those in lots 1 and 2 were sold in July.

Miscellaneous: In 1931 there were 20 steers in lot 1 because the owner was interested in the financial returns and felt that conditions were favorable for feeding on pasture. It was thought 10 steers in lots 2 and 3 were sufficient to supply the desired data.

The seasonal condition of the pastures during the experiment was average.

Results: Given in table 3.

LOUISIANA

EXPERIMENT A

Conducted by: Louisiana Agricultural Experiment Station.

Conducted at: Baton Rouge.

Period: 1930-33.

Purpose: To compare calves on pasture plus feed with a group similar in age and quality on pasture only.

Land history: This was an old farm, located close to the Mississippi River, which was purchased by the State University about 1921. Previously, it had been in rice but there is no record of the treatment which it received. Bermuda grass, white clover, and Dallis grass were volunteer. Cattle had been running on it since 1923. In 1927 seepage caused by high water prevented the mowing of the area and it grew up in weeds and briers. In 1928-29 the drainage had been greatly improved. By 1931 these pastures had good stands of white Dutch clover and Bermuda grass.

Soil: The land, which was composed of heavy black alluvial soil, sloped gently away from the river. By 1931 the surface drainage was fairly good.

Procedure and conditions: The pastures ranged from 40 to 60 acres in area, and consisted of volunteer white Dutch clover, and Bermuda, Dallis, and Vasey grasses. They were mowed at suitable intervals to cut the weeds and tall grass. No fertilizer was applied. The calves on pasture alone were not on the same fields each year.

All calves were in good condition at the beginning of each test.

They were January, February, and March calves. Most of them were steers, but a few were heifers.

The calves in the grain-fed lot were driven to the creeps each day to accustom them to eating. As much feed was put out as they would consume.

The grazing periods were approximately as follows: June 16 to October 14, 1930; July 7 to October 14, 1931; July 16 to October 11, 1932; May 5 to September 15, 1933.

In 1930 grade Hereford, Aberdeen Angus, and Shorthorn calves were used.

In 1931 the calves were a mixed group by Hereford, Aberdeen Angus, and Brahman sires. Four Brahman crossbreds were in the grain-fed group and five in the pasture group. The calves were older and larger than in 1930.

In 1932 and 1933 grade Hereford and Aberdeen Angus calves were used. Two additional lots of calves were incorporated in the test in 1933. One of these contained calves which were creep-fed only the last 70 days of the test; the other contained 12 Brahman crossbreds which were kept on pasture without supplementary feed during the entire period.

The corn fed was No. 3 yellow, the rice bran was secured fresh from the mill as required, and the cottonseed meal was a high-grade meal sold as 8 percent (nitrogen) meal.

The calves had access to natural shade in the pasture. Water was supplied from deep wells.

Miscellaneous: The seasonal condition of the pastures was normal except during the last 6 weeks of the 1933 test when it was somewhat dry.

Results: Given in table 4.

TABLE 4.—*Gains made by calves on pasture only and on pasture plus supplementary feed, Baton Rouge, La., 1930–33*

Year	Period (days)	Calves per lot	Average initial weight		Average gain per head ¹		Feed consumed per head	
			Pasture	Pasture and feed	Pasture	Pasture and feed	Pasture	Pasture and feed ²
	Number	Number	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
1930.....	120	10	259	257	173	219	0	342
1931.....	99	10	300	300	151	194	0	251
1932.....	87	9	354	354	125	151	0	266
1933 ³	133	10	212	214	169	237	0	441
Average.....	110	10	281	281	154	200	0	325

¹ The 4-year average sale value of calves per 100 pounds for the pasture lot was \$5.09, and for the pasture and feed lot \$6.05. In 1933 the lot which was creep-fed the last 70 days only, sold at \$4.34 per 100 pounds, and the lot of Brahman crossbreds on pasture only, sold at \$3.39 per 100 pounds.

² 1930: 143 pounds ground corn, 57.3 pounds cottonseed meal, 142.1 pounds rice polish; 1931: 111.9 pounds whole ear corn (equivalent of 87 pounds shelled corn), 55.9 pounds cottonseed meal, 55.9 pounds rice bran, 27.2 pounds blackstrap molasses; 1932: 7.8 pounds ground shelled corn (on Aug. 18 ground whole ear corn to make $\frac{1}{2}$ of grain mixture was substituted), 71 pounds ground whole ear corn (equal to 47.4 pounds shelled corn), 78.8 pounds wheat bran, 78.8 pounds cottonseed meal, 30 pounds blackstrap molasses; 1933: 230 pounds corn, 100.5 pounds rice bran, 110 pounds cottonseed meal (creep-fed 133 days), 115.8 pounds corn, 57.8 pounds rice bran, 57.8 pounds cottonseed meal (creep-fed last 70 days only).

³ The lot which was creep-fed only the last 70 days of the 133-day period in 1933 gained an average of 217 pounds per head and consumed 231 pounds of feed. The lot of Brahman crossbreds kept on pasture only, gained an average of 235 pounds per head.

BRAY, C. I. Feeding grain to beef calves on pasture before weaning. La. Agr. Expt. Sta. Bul. 249, 19 pp., illus. 1934. See pp. 7–14.

BRAY, C. I., Anim. Husb., La. Agr. Expt. Sta., Baton Rouge, La. Correspondence of July 29 and Aug. 24, 1937.

EXPERIMENT B

Conducted by: Louisiana Agricultural Experiment Station.

Conducted at: Baton Rouge.

Period: 1928-31.

Purpose: To compare grain and grass with grass alone for fattening steers; that is, to determine whether or not grain feeding on pasture can be made profitable, and also to test the effect of such feeding on the quality of meat. The phase dealing with the quality of meat produced is not reported here.

Land history: This was an old farm, located close to the Mississippi River, which was purchased by the State University about 1921. Previously, it had been in rice but there is no record of the treatment which it received. It is presumed that Bermuda grass, white clover, and Dallis grass were volunteer. Cattle had been running on the area since 1923. In 1927 seepage caused by high water prevented the mowing of the area and it grew up in weeds and briers. In 1928-29 the land was drained. By 1931 the pastures had good stands of white Dutch clover and Bermuda, practically all of which had come in naturally without seeding.

Soil: The land, which was composed of heavy black alluvial soil, sloped gently away from the river. By 1931 the surface drainage was fairly good.

TABLE 5.—Gains made by steers on pasture only and on pasture plus supplementary feed, Baton Rouge, La., 1928-31

Item	1928		1929		1930			1931	
	Feed and pasture	Pasture	Feed and pasture	Pasture	Feed and pasture	Pasture ¹		Feed and pasture	Pasture
						A	B		
Area.....acres..	10	(2)	10	(2)	0.6	0.5	0.5	10	(2)
Days on test.....number..	239	239	115	115	148	148	226	119	119
Average initial weight.....pounds..	415	402	570	574	473	514	460	480	483
Average gain per head ⁴do....	375	218	248	184	292	157	283	239	237
Average feed consumed per head: ⁵									
Brewers' rice.....pounds..	837	0	549	0	0	0	0	0	0
Cottonseed meal.....do....	124	0	158	0	255	0	0	134	0
Corn.....do....	0	0	0	0	807	0	0	248	0
Rice bran.....do....	0	0	0	0	0	0	0	100	0
Blackstrap molasses.....do....	42	0	0	0	0	0	0	87	0
Sale price per 100 pounds.....dollars..	10.68	8.75	11.94	9.89	7.91	6.64	6.62	6.92	6.60

¹ Lot B was pastured 78 days longer than lot A.

² Unlimited.

³ Undetermined.

⁴ There were usually 10 steers in each lot.

⁵ Calculated by the Southern Division, A. A. A.

BRAY, C. I. Fattening cattle with grain on pasture. La. Agr. Expt. Sta. Ann. Rept. (1928-29), 67 pp. 1930. See pp. 27, 28.

BRAY, C. I. Fattening steers of different ages on pasture with and without grain, and influence of method on quality of meat. La. Agr. Expt. Sta. Bul. 296, 43 pp., illus. 1938. See pp. 16-30.

BRAY, C. I. Grain on grass compared with grass alone for fattening steers. Amer. Soc. Anim. Prod., Proc. 23d Ann. Meeting (1930), 329 pp., illus. 1931. See pp. 161, 162.

BRAY, C. I., Anim. Husb., La. Agr. Expt. Sta., Baton Rouge, La. Correspondence of July 29 and Aug. 24, 1937.

Procedure and conditions: The pastures were mowed at suitable intervals to cut the weeds and tall grass. No fertilizer was applied.

Grade Angus, Hereford, Shorthorn, and one-half Brahman yearling and 2-year-old steers were used. They had been wintered on

pasture and hay and were usually in thin condition when the experiments began. Those which received grain were confined to small fields between 6 and 10 acres in area. They were fed once daily. Those which did not receive grain usually ran in fields from 28 to 40 acres or more in area. The steers had access to natural shelter only. Water was supplied from deep wells.

The tests made in 1932 and 1933 are not included in this report because the experimental conditions were not comparable. In 1929, 1930, and 1931 different lots of yearling cattle from the university herd, fed grain on pasture, were included in the experiment. These lots are not included in the present report.

Results: Given in table 5.

MISSISSIPPI

EXPERIMENT A

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College.

Period: 1933-35.

Purpose: To compare the effects of fattening steers on pasture alone and on pasture plus varying amounts of cottonseed meal or cake, and to determine the most practical length of feeding period.

Land history: The land had been in permanent pasture 25 years or more.

Soil: The soil consisted of Oktibbeha and Houston clays. The land had a 10- to 15-percent slope, and there was no erosion.

Procedure and conditions: Three pastures, fairly typical of the northeastern prairie section, were used each year. Lots 1 and 2 were each on a 33-acre pasture. The same pastures were used each year for these two lots. Lot 3 was on an 89-acre pasture in 1933, and on a 58-acre pasture the last 2 years.

From the beginning of the grazing season to May 15, approximately 90 percent of the pasturage was yellow hop clover, and the remaining 10 percent consisted of wild barley, cheat, white clover, and black medic. From about May 15 to the end of the grazing season, Dallis grass furnished about 80 percent of the grazing. Small amounts of Bermuda grass, crabgrass, and lespedeza were present. There was an abundance of grazing on all pastures except during a brief dry period from June 25 to July 12, 1933. The pastures were clipped with a mowing machine at least once during each grazing season to keep the grass tender and to destroy weeds, brush, and briars. No fertilizer was applied. Trees afforded shade, and water was supplied by ponds or pools.

Each year three lots of 2-year-old steers were used. All lots were on pasture, but lot 1 received, in addition, 5 pounds of cottonseed meal or cake (broken-slab type) per steer per day, and lot 2 received 2½ pounds of the same feed per steer per day. The meal or cake, which analyzed at least 41 percent protein, was fed each morning in troughs.

In 1933, Jersey or Yellow Hammer steers which were in thin but thrifty condition were used. They had been wintered without shel-

ter on about 15 pounds of sorghum silage, one-half pound of cottonseed meal, and 7 pounds of Johnson grass per steer per day, until being placed on pasture on April 1.

In 1934 medium grade steers, mostly all first crosses from native or Jersey cows sired by an Angus bull, were used.

In 1935 good grade Herefords and a few good crossbreds, which had been wintered on Johnson grass hay fed under a shelter, were used. This group showed more evidence of beef breeding than either of the other previous groups.

During the 1933 test 12 steers were taken, on August 11, from each lot of 24 and shipped to market, and the remaining steers on each lot (designated as lots 1A, 2A, and 3A) were continued in the experiment until October 3. The steers remained on the same pastures throughout the 1933 test, but in 1934 and 1935 the lots were rotated on the three pastures every 21 days.

TABLE 6.—*Gains made by steers on pasture only and on pasture plus supplementary feed, State College, Miss., 1933–35*

Item	1933 ¹					
	Apr. 20-Aug. 11			Apr. 20-Oct. 3		
	Lot 1, 5 pounds cotton- seed cake	Lot 2, 2.5 pounds cotton- seed cake	Lot 3, pasture only	Lot 1A, 5 pounds cotton- seed cake	Lot 2A, 2.5 pounds cotton- seed cake	Lot 3A, pasture only
Area.....acres.....	33	33	89	33	33	89
Steers.....number.....	12	12	12	12	12	12
Days on pasture.....do.....	113	113	113	166	166	166
Average initial weight.....pounds.....	516	508	501	491	489	501
Total gain per steer.....do.....	220	214	216	302	307	287
Feed consumed per steer ²do.....	565	282	0	830	415	0
Sale price per 100 pounds.....dollars.....	3.00	3.10	2.90	2.67	2.62	2.58

Item	1934			1935		
	Lot 1, 5 pounds cotton- seed meal	Lot 2, 2.5 pounds cotton- seed meal	Lot 3, pasture only	Lot 1, 5 pounds cotton- seed meal	Lot 2, 2.5 pounds cotton- seed meal	Lot 3, pasture only
Area.....acres.....	33	33	58	33	33	58
Steers.....number.....	10	10	10	10	10	10
Days on pasture ³do.....	121	121	121	133	133	133
Average initial weight.....pounds.....	703	701	702	673	680	677
Total gain per steer.....do.....	221	220	208	268	230	225
Feed consumed per steer ²do.....	605	302	0	665	332	0
Sale price per 100 pounds.....dollars.....	(⁴)	(⁴)	(⁴)	7.85	7.00	7.60

¹ The steers in lots 1 and 2 were on the same 33-acre pasture as those in lots 1A and 2A, respectively, and the steers in lot 3 were on the same 89-acre pasture as those in lot 3A. The results are given separately to emphasize the difference in length of feeding period between the 12 steers which were taken off the pasture after 113 days (on Aug. 11), and those which were left on the pasture until the end of the experiment.

² Calculated by the Southern Division, A. A. A.

³ Grazing period: May 2-Aug. 31, 1934; Apr. 16-Aug. 26, 1935.

⁴ At the end of the 1934 test, 8 steers from lot 1 were graded as medium, 1 as good, and another as choice; 7 steers from lot 2 were graded as medium, and 3 as good; and 5 steers from lot 3 were graded as medium, and 5 as good.

MEANS, R. H., Assoc. Anim. Husb., Miss. Agr. Expt. Sta., State College, Miss. Correspondence of June 7, 1937. (Unpublished.)

CLARK, C. F., Coordinator Res. Inf., Miss. Agr. Expt. Sta., State College, Miss. Correspondence of May 11, 1937.

The pastures were uniform each year with regard to quality, quantity, water, and shade. Rock salt was available at all times. The steers were turned on pasture 20 or 30 days before beginning the experiment in order to allow them to become accustomed to the pasture, and also to allow the grass and clovers to make a good growth. Weights were taken at the beginning and end of each test, and during 1934 and 1935 they were also taken at the end of each 210-day period, at the time of rotating the lots.

Results: Given in table 6.

EXPERIMENT B

Conducted by: Mississippi Agricultural Experiment Station, State College, in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture.

Conducted at: In 1915, at Abbott, Clay County, on the farm of Mr. Ben Walker. In 1916, near Canton, Madison County, on the Canton Stock Farm.

Period: 1915, 1916.

Purpose: To compare pasture alone with pasture plus cottonseed cake for fattening steers in the summer for the early fall market.

Soil: The soil in Clay County was typical of the black prairie section and carried a good supply of lime. The land was slightly rolling. The soil in Madison County was classified as brown loam, and was very fertile.

Procedure and conditions: For purposes of clarity the tests for each year are explained separately.

Clay County—1915

Two pastures which were practically equal in size and in the area of grazing furnished for each lot were used. They consisted mainly of lespedeza, Bermuda grass, and crabgrass.

Forty steers were divided into 2 lots of 20 each. Both lots were on pasture and lot 2 received a supplementary feed of cottonseed cake. The steers were ordinary natives of mixed or inferior breeding. Jersey blood predominated, but a few showed evidences of Angus and Shorthorn blood. They had been wintered on cottonseed meal, cottonseed hulls, and corn silage, and were in good condition when the experiment began.

The cottonseed cake fed to lot 2 was of high quality, analyzing 43 percent crude protein. Steers in this lot were fed each evening about sundown, the cake being placed in troughs in the pasture.

Pools in the open pastures, which became very low and foul during the extended dry period, furnished the only source of water supply for the steers. Salt was provided each week.

The cattle were weighed every 28 days. As the cattle were free from ticks, they were not dipped.

Miscellaneous: Owing to a dry period, the pastures were not available until May. In midsummer a 2-month drought almost ruined the pastures for the season. Rains during the latter part of August also injured them somewhat.

Madison County—1916

The two pastures were quite similar to those in Clay County (1915). The principal plants which furnished grazing were lespedeza, Paspalum, Bermuda grass, white clover, and some crabgrass. No stock had been on the pastures before the experiment began, so an abundance of grass and clover was available throughout the experiment. The two lots of steers were interchanged from one pasture to the other, so that discrepancies due to a difference in pastures might be avoided.

The stock used were inferior mature steers with no special breeding. Jersey breeding was the most evident, while a few showed marks of Shorthorn, Hereford, Aberdeen Angus, Red Polled, and Devon breeding. As a whole they were typical scrub steers of the South and few were good feeders. All but 15, which were raised on the farm, had been bought in Madison County early in May. They were divided into 2 lots of 30 each, as equal as possible in size, condition, and quality. The cattle were weighed every 28 days. Since Madison County is in tick-free territory, it was unnecessary to dip the animals.

Cottonseed cake of good quality, cracked to nut size, and containing about 39 percent crude protein, was fed the steers of lot 2 about sundown each day. Feed was placed in troughs in the open pasture. Water was obtained from ditches and pools in the pastures.

Miscellaneous: Heavy rains sometimes left pools of water on the pastures and made the grass rather "washy." Some improvement was brought about by clipping the pastures with a lawn mower late in July.

Results: Given in table 7.

TABLE 7.—*Gains made by steers on pasture only and on pasture plus cottonseed cake, Clay and Madison Counties, Miss., 1915, 1916*

Item	1915		1916		2-year average ¹	
	Lot 1, pasture	Lot 2, pasture plus cotton- seed cake	Lot 1, pasture	Lot 2, pasture plus cotton- seed cake	Lot 1, pasture	Lot 2, pasture plus cotton- seed cake
Steers.....number..	20	20	30	30	25	25
Days on pasture.....do..	107	107	134	134	120	120
Average initial weight per steer..pounds..	678	678	662	664	670	671
Average total gain per steer.....do..	180	214	214	257	197	² 236
Total cottonseed cake consumed per head ³ pounds..	0	369	0	580	0	474
Sale price per 100 pounds.....dollars..	5.75	6.35	5.85	6.10	5.80	6.22

¹ Calculated by the Southern Division, A. A. A.

² Calculated by the Southern Division. Given in U. S. Dept. Agr. Bul. 777 as 205 pounds.

³ At the beginning of the experiment each year, the steers were fed at the rate of 2 pounds per day per steer. This ration was gradually increased to 4 pounds by the end of the first month during the 1915 experiment, and to 5 pounds by Aug. 1, 1916. These rates were then continued until the end of each year, respectively.

WARD, W. F., and LLOYD, E. R. Fattening steers on summer pasture in the South. U. S. Dept. Agr. Bul. 777, 24 pp., illus. 1919. See pp. 12-19.

MOORE, J. S., Prof. Anim. Husb., Miss. Agr. Expt. Sta., State College, Miss. Correspondence of June 3, 1937.

EXPERIMENT C

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College.

Period: 1917.

Purpose: To compare pasture alone with pasture plus cottonseed meal for fattening steers during the summer.

Procedure and conditions: The pastures consisted of Bermuda with a little clover and Paspalum. The pastures were not fertilized.

In the spring of 1917, twenty-four 2-year-old beef steers were divided into two lots equal in number and as nearly equal as possible in breeding, quality, condition, and weight. Both lots were grazed for 112 days, from March 28 to July 18.

Lot 1 received no feed other than pasture. In addition to pasture lot 2 received 3 pounds of cottonseed meal per day during the first 56 days, 5 pounds per day during the next 28 days, and 6 pounds per day during the last 28 days, or an average of 4.3 pounds per steer per day.

Miscellaneous: On lot 1 grazing was fairly good from March 18 to May 23; from May 23 to June 20 there was an abundance of hop clover, and grazing was very good; from June 20 to July 18 grazing was good although the grass was rather short and dry. On lot 2 little clover was present and grazing was poor from March 18 to June 20; grazing was fairly good from June 20 to July 18.

Results: Given in table 8.

TABLE 8.—Gains made by steers on pasture only and on pasture plus cottonseed meal during the summer, State College, Miss., 1917

Item	Lot 1, pasture	Lot 2, pasture plus cottonseed meal
Steers per lot.....number.....	12	12
Average initial weight per steer.....pounds.....	629	631
Average gain per steer.....do.....	269	317
Total cottonseed meal per steer.....do.....	0	477
Sale price per 100 pounds.....dollars.....	8.25	8.50

BARNETT, E., and GOODELL, C. J. Feeding cottonseed meal to steers on grass. Miss. Agr. Expt. Sta. Cir. 50, 3 pp. 1923. See pp. 1, 2.

MEANS, R. H., Assoc. Anim. Husb., Miss. Agr. Expt. Sta., State College, Miss. Correspondence of June 7, 1937.

EXPERIMENT D

Conducted by: Mississippi Agricultural Experiment Station.

Conducted at: State College.

Period: 1900.

Purpose: To compare the milk production of cows on pasture alone and on pasture plus supplementary feed.

Land history: The land had been cleared for about 50 years. For many years prior to 1895 there were no crops on the land and the hillside became badly eroded. In about 1895, about 30 pounds per acre of mixed grass seed was sown in the fall, and Bermuda sod was set out whenever labor was available. No fertilizer was used.

Soil: The soil was a Selma chalk. The land had a 20-percent slope.

Procedure and conditions: The pasture area contained about 9

acres. Bermuda grass was the main pasture plant, but some white and hop clovers were also present.

Jersey cows 5 to 10 years old were divided into two lots, with three cows in lot 1, and six cows in lot 2. The animals received no special preparation for the experiment but they were in good condition at the outset. No shelter was provided.

For 6 weeks, beginning April 6, all of the cows in both lots received 4 pounds of cottonseed meal and 6 pounds of wheat bran per cow, per day. During the last 6 weeks, lot 1 received no grain ration, and lot 2 was fed 3 pounds of cottonseed meal and 4 pounds of wheat bran per cow, per day.

Miscellaneous: During the last 6 weeks of the experiment rainfall was heavy and horn flies worried the cows.

Results: The results for the last 6 weeks only, May 18 to June 29, are given in table 9.

TABLE 9.—*Milk production from cows on pasture only and on pasture plus supplementary feed, State College, Miss., 1900*

Lot and treatment	Average yield of milk per cow, May 18-June 29 ¹						
	First week	Second week	Third week	Fourth week	Fifth week	Sixth week	Total
Lot 1, pasture.....	Pounds 85	Pounds 82	Pounds 73	Pounds 79	Pounds 72	Pounds 69	Pounds 460
Lot 2, pasture plus feed ²	120	120	109	112	104	102	667

¹ Calculated by the Southern Division, A. A. A.

² Cows consumed a total of 126 pounds of cottonseed meal and 168 pounds of wheat bran, per head (calculated by the Southern Division on the basis of 3 pounds of cottonseed meal and 4 pounds of wheat bran per cow per day for 42 days).

MOORE, J. S. Grain feeding in pasture. Miss. Agr. Expt. Sta. Ann. Rept., 42 pp. 1900. See pp. 31-33.

MOORE, J. S., Prof. Dairy Husb., Miss. Agr. Expt. Sta., State College, Miss. Correspondence of June 3, 1937.

NORTH CAROLINA

Conducted by: Bureau of Animal Industry of the United States Department of Agriculture, in cooperation with the North Carolina Agricultural Experiment Station, Raleigh.

Conducted at: Haywood County, N. C., on the farm of Mr. T. L. Gwyn.

Period: 1914-19.

Purpose: To compare the gains of steers on pasture only and on pasture plus cottonseed cake. (This was part of an extensive experiment concerned largely with wintering cattle, especially as it affected gains the following summer.)

Land history: Most of the pastures used had been established for some time.

Soil: All the land used was western North Carolina cut-over timberland, on which some of the old dead trees were still standing. It was rolling and hilly, and some portions were rough and steep.

Procedure and conditions: The experiment was planned to cover 3-year periods in order to get an average of any conditions tending to produce variation. It was run on the same land each year. The pastures consisted of a mixture of orchard grass, bluegrass, herd's-grass, clover, and timothy.

Although most of the pastures were already established, some new land was prepared. The following two methods of seeding were used:

(1) Farmers of the community were given free use of the land for 2 years, provided they deadened all large trees, cleared out small brush, and planted the land to corn. The land was plowed very shallow and corn rows run around the hill to prevent washing. At the last cultivation of corn the second year, a mixture of 15 pounds of orchard grass, 4 pounds of bluegrass, and 7 pounds of timothy and clover per acre was sown broadcast. A firm sod was soon produced, and orchard grass grew knee high by fall.

(2) Land was burned over thoroughly before the timber leafed out, and the larger trees were deadened. Pasture seed was sown by hand after the ashes had cooled, the first rains beating it into the ground. The land was neither plowed nor harrowed. A few cattle were grazed soon after grass appeared as this kept the land clean and the packing helped make better sod.

By the first method it was necessary to let the pasture grow 1 year before it could be used at all. By the second method, the land was not grazed heavily during the first summer as it would have injured the pasture materially for winter pasture purposes.

TABLE 10.—*Summer gains made by steers on pasture only and on pasture plus cottonseed cake, Haywood County, N. C., 1914-19*

Lot No.	Treatment the preceding winter ¹	Summer treatment	Days on pasture	Average—			
				Steers per lot	Initial weight per steer ²	Gain per steer	Sale price per 100 pounds
2-year average, 1915-16: ³			<i>Number</i>	<i>Number</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Dollars</i>
1-a-----	Feed	Pasture	140	12	740	378	7.13
1-b-----	do	Pasture plus feed	134	12	766	² 346	8.00
2-a-----	do	Pasture	140	12	732	357	7.13
2-b-----	do	Pasture plus feed	134	12	742	² 386	8.00
3-year average, 1917-19:							
1-----	do	Pasture	140	26	731	337	(⁴)
2-----	do	do	140	25	728	336	(⁴)
3-----	do	do	140	28	691	340	(⁴)
4 ⁵ -----	Pasture	do	140	27	727	333	(⁴)
6-year average, 1914-19: ³							
3-----	Feed	do	144	31	674	349	8.51
4 ⁵ -----	Pasture	do	146	24	706	334	8.75

¹ Steers were wintered on dry lot, either on concentrates or on pasture alone, as designated. From 1914 to 1916, they were fed during the preceding winter as follows: Lot 1, ear corn, and a light ration of corn stover, hay, and straw; lots 2 and 3, corn silage, corn stover, hay, and straw; lot 4, winter pasture. From 1917 to 1919 they were wintered as follows: Lot 1, mixed hay; lot 2, corn silage; lot 3, corn silage, corn stover, straw; lot 4, winter pasture. The same pastures were used during winter and summer.

² Calculated by the Southern Division, A. A. A.

³ During the summer of 1914, all steers in lots 1 and 2 were fed grass and cottonseed cake. During the following 2 years the lots were divided into lots 1-a and 2-a and lots 1-b and 2-b. The steers on lots 1-b and 2-b each consumed 528 pounds of cottonseed cake per head.

⁴ The average actual sale price at the end of the summer period was \$10.17 per hundred pounds.

⁵ During snows the steers were brought into the barn and fed a small ration of dry roughage or dry roughage and ear corn combined.

WARD, W. F., CURTIS, R. S., and PEDEN, F. T. Wintering and fattening beef cattle in North Carolina U. S. Dept. Agr. Bul. 623, 53 pp., illus. 1918. See pp. 1-6, 15-17, 20-23, 28, 31-37.

PARLEY, F. W., PEDEN, F. T., and CURTIS, R. S. Wintering and summer fattening of steers in North Carolina. U. S. Dept. Agr. Bul. 954, 18 pp., illus. 1921. See pp. 2-7, 10, 11, 16-17.

The cattle were all western North Carolina-grown steers. Most of them were 2-year-olds, averaging about 800 pounds each when purchased in the fall. They were a good lot of grade cattle princi-

pally of Shorthorn breeding, with some Aberdeen Angus, Hereford, and Devon blood. All lots were as nearly uniform as possible in weight and quality. Individual records were kept for each steer.

The steers were divided into four lots in the fall, except in 1919 when there were five lots. Each lot consisted of about a carload of cattle. After the steers had been wintered on various concentrates or pasture, they were carried through the summer on grass or on grass plus cottonseed cake. In 1914, all steers in lots 1 and 2 received a supplementary feed of cottonseed cake, but during the next 2 years, 1915 and 1916, the two lots were divided, half of each receiving a small amount of cottonseed cake as supplementary feed and the other half being grazed without feed. From 1917 through 1919 lots 1 and 2 were on grass alone. Lots 3 and 4 were grazed without feed during all 6 years. (Lot 5 is disregarded because it represents results of only 1 year's work.)

The steers were turned on pasture in the spring as soon as the grass would carry them without injury to its subsequent growth. About 3 acres per steer were allowed for grazing. High grade cottonseed cake, which had been cracked on the farm by running through a corn-and-cob mill, was fed late each afternoon in troughs in the pasture. Salt was provided once a week. Every 4 weeks the steers were weighed.

The summer feeding period was approximately from April 15 to September 1. Steers from all lots were sold each fall when they were removed from pasture.

Results: Given in table 10.

TENNESSEE

Conducted by: Tennessee Agricultural Experiment Station, Knoxville.

Conducted at: Middle Tennessee Station, Columbia.

Period: 1929-36.

Purpose: To compare the gains of 2-year-old steers on pasture alone and on pasture supplemented with varying amounts of grain; and to determine the grain necessary to produce the most economical gains, and at the same time meet local market requirements.

Land history: The land had been cleared for 75 years, and had been in permanent pasture most of the time since being acquired by the University of Tennessee in 1917. Previous to that time it had been used mainly in the usual rotation of corn, oats, wheat, clover, and grass. It was badly eroded at the time the university took it over.

Soil: The soil was a Maury silt loam; the land had a 10-percent slope.

Procedure and conditions: The experiment was begun in 1929, but all pastures had been established at least several years before that date. Seedings were made in September, February, and early March. Clippings were made in May or June and again in July or August in order to improve the pastures.

The pastures have received applications of 9 tons of stable manure two or three times during the past 15 years. These applications were made between December and February, inclusive, with a manure spreader.

The pastures were often larger than the cattle needed, but the groups were rotated to equalize the benefits of the pastures.

The cattle, consisting of 2-year-old grade or medium grade Hereford steers, were divided into five uniform lots of five steers each. One lot received neither grain nor roughage. The other four lots received supplementary feed. All lots were kept on uniform pasture continuously during the grazing season.

Miscellaneous: It is estimated that the following percentages approximate the pasturage used by the cattle during the tests: Bluegrass, 50 percent; crabgrass, 15 percent; hop clover, 20 percent; miscellaneous wild grasses and weeds, 10 percent; white clover, orchard grass, and lespedeza, 5 percent.

Some hay, hop clover, and bluegrass seed were harvested at times from the pastures.

A record heat and drought occurred in 1930, and severe heat with less serious drought occurred in 1931. The remainder of the summers tended to higher than average temperatures and damaging droughts at some time in the season.

TABLE 11.—Gains made by 2-year-old steers on pasture only and on pasture plus varying amounts of supplementary feed, Columbia, Tenn., 1933–36¹

Item	Lot 1, pasture only	Lot 2, pasture plus 5 pounds corn-and- cob meal	Lot 3, pasture plus 5 pounds corn-and- cob meal plus 1 hay ²	Lot 4, pas- ture plus 4 pounds corn-and- cob meal plus 1 pound cot- tonseed meal	Lot 5, pasture plus 10 pounds corn-and- cob meal
Average initial weight:					
1933.....pounds	711	703	745	743	714
1934.....do	793	770	739	790	719
1935.....do	705	738	718	691	721
3-year average ⁴do	736	737	734	741	718
Average gain per steer: ^{4 5}					
1933.....do	208	243	237	274	222
1934.....do	208	219	254	242	260
1935.....do	151	176	164	185	197
3-year average ⁴do	189	213	218	234	226
Average sale price per 100 pounds:					
1933.....dollars	4.65	4.50	4.85	4.65	5.00
1934.....do	5.70	5.70	6.00	6.00	6.00
1935.....do	8.03	8.50	8.66	8.33	9.00
3-year average ⁴do	6.13	6.23	6.50	6.33	6.67

¹ Steers were grazed 160 days in 1933; 152 days, Apr. 7 to Sept. 6, 1934; 117 days, Apr. 6 to Aug. 1, 1935.

² All feeds were given on a "per steer per day" basis. Corn-and-cob meal was crushed.

³ As much hay as the steers would consume.

⁴ Calculated by the Southern Division, A. A. A.

⁵ 4-year average gains per steer (1933–36) were as follows: Lot 1, 172 pounds; lot 2, 192 pounds; lot 3, 202 pounds; lot 4, 207 pounds; lot 5, 208 pounds. The grazing period in 1936 lasted only 76 days (Apr. 15 to June 30) because of a severe drought. Average initial weight and sale price not available for the 4-year period.

JACOB, M. Beef-cattle-feeding experiments. Tenn. Agr. Expt. Sta. Ann. Rept. (1933), 56 pp. 1934. See p. 30.

JACOB, M. Beef-cattle-feeding experiments. Tenn. Agr. Expt. Sta. Ann. Rept. (1934), 39 pp. 1935. See p. 10.

JACOB, M. Beef-cattle-feeding experiments. Tenn. Agr. Expt. Sta. Ann. Rept. (1935), 51 pp., illus. 1936. See pp. 18, 19.

JACOB, M. Beef-cattle-feeding experiments. Tenn. Agr. Expt. Sta. Ann. Rept. (1936), 71 pp., illus. 1937. See p. 20.

NEEL, L. R., Supt., Middle Tenn. Expt. Sta., Columbia, Tenn. Correspondence of June 14, 1937.

The work was not carried on in 1932. Frequent variations in conditions as a result of drought made it impossible to arrive at definite conclusions until 1933.

Results: Given in table 11.

Comparative Methods of Pasture Establishment

SOUTH CAROLINA

Conducted by: South Carolina Agricultural Experiment Station, Clemson.

Conducted at: Coast Station, Summerville.

Period: 1930-33.

Purpose: To compare several methods of preparing cut-over coastal lands for carpet grass and lespedeza pasture.

Land history: The land had been cleared approximately 10 years before this experiment. It was not cropped but consisted of cut-over coastal lands converted into permanent pasture.

Soil: Coxville sandy loam.

Procedure and conditions: Three plots of 1 acre each were set out on an area which had a complete sod of broomsedge and other native grasses of little feed value, as well as a few low bush oaks and gallberry bushes. Freshly prepared land was used each year, and each year's work constituted a separate experiment.

The three methods of preparing the land were as follows:

PLOT 1. Burned in late winter.

PLOT 2. Burned, disked with tractor tandem disk harrow, and harrowed with smoothing harrow.

PLOT 3. Burned, plowed, disked with tractor tandem disk harrow, and harrowed with smoothing harrow.

TABLE 12.—Average count of carpet grass seedlings per acre on cut-over land prepared by several methods, Summerville, S. C. 1931-33

Year	Carpet grass seedlings per acre		
	Plot 1, burned	Plot 2, burned, disked, and harrowed	Plot 3, burned, plowed, disked, and harrowed
	<i>Number</i>	<i>Number</i>	<i>Number</i>
1931.....	97,574	235,866	667,688
1932.....	2,788	588,931	1,113,045
1933.....	9,767	384,622	500,417
3-year average.....	36,710	1 403,140	1 760,383

¹ Calculated by the Southern Division, A. A. A. The Forty-sixth Annual Report gives 404,623 plants as the average for plot 2, and 760,380 plants as the average for plot 3.

KYZER, E. D. A comparison of methods of preparing cut-over coastal lands for carpet grass pasture. S. C. Agr. Expt. Sta. Ann. Rept., 189 pp., illus. 1933. See pp. 121, 122.

STARKEY, L. V., Head, Anim. Husb. Dept., S. C. Agr. Expt. Sta., Clemson, S. C. Correspondence of Jan. 17, 1938.

In late March after the rains had settled the soil on plots 1 and 2 into a fairly firm seed bed, all the plots were seeded broadcast to 10 pounds of carpet grass and 5 pounds of common lespedeza per acre, after which they were harrowed with a smoothing or drag harrow.

Stand counts were taken at numerous points in each plot in mid-summer.

Cattle were kept on the pastures continuously during the experiment, and the plots were closely grazed.

Miscellaneous: The seasonal condition of the pastures during the experiments was average.

Although an experiment in this series was conducted in 1930 it was merely a preliminary study. For that reason it is not included here.

Results: Given in table 12.

Comparative Improvement in Pasture Through Choice of Seed ²

FLORIDA

EXPERIMENT A

Conducted by: Florida Agricultural Experiment Station, in cooperation with the Division of Forage Crops and Diseases, Bureau of Plant Industry of the United States Department of Agriculture, and the J. C. Penney-Gwinn Corporation.

Conducted at: Clay County (native and partially improved pastures) and at Gainesville (improved pasture).

Period: 1929-33.

Purpose: To compare native, partially improved, and improved pastures for grazing steers.

Land history: The improved pastures were on hammock land which had originally been a native wooded area growing magnolia, pine, and other timber. In 1924 and 1925 it was cleared, and in 1926 and 1927 it was cultivated and planted to carpet grass, Bahia, Bermuda, centipede, and to a mixture of these four grasses. Grasses were broadcast with a cyclone seeder, except centipede grass, which was set by hand.

Soil: The native and partially improved pastures were largely on poorly drained cut-over flatwoods, consisting of Leon, Portsmouth, and Blanton soils. They were not the best of the flatwoods soils for pasture or pine reproduction but representative of a large body of lands in the State.

The improved pastures (Gainesville) were for the most part on well drained upland Hernando soil, although a little Portsmouth, Fellowship, and Norfolk fine sandy loams were also included. The area is not considered the best grade of upland soil but it is representative of a certain area of the State. The soils of the areas represented by the native and partially improved pastures were not strictly comparable with that of the improved pastures. The native and partially improved pastures were comparable.

The land ranged from fairly level to a gentle slope.

Procedure and conditions: The two native pastures were on cut-over pine land which had a scattering growth of longleaf and slash pine and native grasses, with wire grass predominating. The partially improved pastures were the same, with the exception that parts of each area were disked and seeded to carpet grass in May 1930.

² See also tables Nos. 21, 22, 26, 28, 30, 31, 33, 34, 37, 40, and 41.

The improved pasture consisted of five 3.5-acre areas, seeded to Bahia, Bermuda, carpet, centipede, and to a mixture of these four grasses, respectively. Each pasture was fenced. Native pastures were 240 acres in area, and the partially improved pastures were 40 acres. All seeding was done with a cyclone seeder, except centipede grass, which was set by hand. The same pastures were used each year.

Native and partially improved pastures were not fertilized. Improved pastures were fertilized as follows: Beginning with the spring of 1929 each pasture was given sodium nitrate, applied as a top dressing, twice a year at the rate of 50 pounds per acre. The early applications were made in February or March, and the later applications in May or July. An exception occurred in 1932 at the time of the early application, at which time a complete fertilizer (top dressing) consisting of 25 pounds of nitrate of soda per acre, 67 pounds cottonseed meal per acre, 100 pounds superphosphate per acre, and 25 pounds of muriate of potash per acre was applied.

Native steers were grazed on the native and partially improved pastures, and native and grade steers were grazed on the improved pastures. The animals were about 2 years old, and averaged about 500 pounds each. They were rather thin at the beginning of the experiment.

Results: Given in table 13.

TABLE 13.—*Gains made by steers on native, partially improved, and improved pastures, Clay County, and Gainesville, Fla., 1930-33*

Type of pasture	Kind of grass	Grazing period per year ¹	4-year average, 1930-33	
			Area per steer	Gain per steer
		Months	Acres	Pounds
Native.....	Wire.....	9	16.0	131
Do.....	do.....	9	21.0	125
Partially improved.....	Wire and carpet.....	9	6.5	105
Improved ²	Bahia, Bermuda, carpet, centipede.....	9	.8	156

¹ The 9-month periods were from March to November, inclusive.

² 5-year average of 5 pastures.

STOKES, W. E., and SHEALEY, A. L. Comparison of native and improved pastures. Assoc. Sou. Agr. Workers, Proc. 36th Ann. Conv., pp. 349-600. 1935. See pp. 455, 456.
 RITCHEY, G. E., and STOKES, W. E. Pasture experiments. Fla. Agr. Expt. Sta. Ann. Rept., 184 pp., illus. 1931. See p. 35.
 STOKES, W. E., agron. Correspondence with H. H. Hume, Asst. Dir. Res., Fla. Agr. Expt. Sta., Gainesville, Fla., June 15, 1937.

EXPERIMENT B

Conducted by: Florida Agricultural Experiment Station, in cooperation with the Division of Forage Crops and Diseases, Bureau of Plant Industry of the United States Department of Agriculture.

Conducted at: Gainesville.

Period: 1926-33.

Purpose: To determine the relative grazing value of several promising Southern pasture grasses.

Land history: The land was cleared in 1924 and 1925, having previously been a native wooded area growing magnolia, pine, and other timber.

Soil: The soil was mainly Hernando medium to fine sand, with a small area of Norfolk fine sandy soil, and a narrow strip of Portsmouth soil. The land was comparatively level except for a gentle slope on about half of it. There was very little erosion.

Procedure and conditions: In the spring of 1926, 17½ acres of land were broken with a turning plow and disked. Later the land was crossbroken, redisked, and thoroughly harrowed with a spike-tooth harrow.

The area was then divided into five pastures of 3½ acres each, arranged so as to give as nearly as possible the same type of soil on each pasture. Fresh water was supplied by a stream which crossed the center of all pastures.

In June 1926 the five pastures were sown broadcast to Bahia, Bermuda, carpet, Dallis, and a mixture of these four grasses, respectively. Bahia, carpet, and Dallis grass were each planted at the rate of 12.8 pounds per acre, and Bermuda at the rate of 8.6 pounds per acre. The mixture rate per acre was as follows: Bahia, 1.4 pounds; Bermuda, 2.2 pounds; carpet, 2.4 pounds; and Dallis, 3.4 pounds, or a total of 9.4 pounds per acre.

The Dallis grass plot made very poor growth during 1926 and 1927. In September 1927 it was plowed and disked and on October 15, 1927, it was sodded to centipede grass in rows 5 feet apart.

During the summers of 1926, 1927, and 1928 the pastures were mowed frequently and were kept well grazed to control weed and grass growth. The same plots were used continuously throughout the experiment.

On February 28, 1928, all pastures were given a top dressing of 25 pounds of nitrate of soda, 67 pounds of cottonseed meal, 100 pounds of superphosphate, and 25 pounds of muriate of potash, per acre. Two applications of 100 pounds of nitrate of soda per acre were made in May and June, respectively.

Beginning with the spring of 1929 each pasture was given sodium nitrate twice a year, applied as a top dressing at the rate of 50 pounds per acre. The early applications were made in February (1929, 1931, and 1932) or March (1930 and 1933), and the late applications were made in May (1929, 1930, and 1931) or July (1932 and 1933). An exception occurred in 1932 at the time of the early, or February, application, at which time a complete fertilizer similar to that applied on February 28, 1928, was substituted for the regular spring application of sodium nitrate.

In the spring of 1929 one plot, 20 by 20 feet, was fenced off within each pasture to be used for determining grass yields by clippings. In the spring of 1930 the number was increased to three plots in each pasture and reduced in size to 20 by 10 feet. The plots were moved to a new area each spring. They were clipped with a lawn mower every 4 weeks. The average date of the first cuttings was March 20 and of the last cuttings November 18, making an average of 244 days between the first and last cuttings.

Experimental grazing was begun on the Bahia, Bermuda, carpet grass, and mixed grass pastures in March 1929. Grazing was begun on the centipede pasture in 1930. The steers used were grade Hereford, grade Angus, and native scrubs, which had been raised under Florida range conditions and were brought to the farm in the fall

before being used in the test the following spring. They were wintered under uniform conditions and were placed on pasture as early in the season as the growth of grass would permit. The steers were divided each season into lots comparable in grade and weight.

In 1929 five steers were grazed on each pasture; during the other 4 years there were four steers per lot.

When steers died or had to be removed from pastures they either were replaced or their gains were calculated by using the average gains of the steers remaining on pasture.

In 1930 and 1931 the steers were dipped at 14-day intervals for tick eradication. No supplementary feed was given. During each grazing season the steers had access to common salt and finely ground feeding bonemeal.

Miscellaneous: In the spring of 1933 a survey of the plant population showed the following percentages: 90 percent Bahia grass on the Bahia pasture; 63 percent Bermuda grass on the Bermuda pasture; 58 percent carpet grass on the carpet grass pasture; 87 percent centipede grass on the centipede pasture; and almost an even distribution of Bahia, Bermuda, and carpet grass on the mixed pasture.

The seasonal condition of the pastures during the experiment was about normal, or a little drier than normal.

Results: Given in table 14.

TABLE 14.—*Gains made by steers on, and yield of oven-dry grass per acre from specified pasture grasses, Gainesville, Fla., 1929–33*

Grasses	5-year average, 1929–33		
	Initial weight per steer	Gain per steer ¹	Yield of oven-dry grass per acre ²
	Pounds	Pounds	Pounds
Bahia.....	521	161	2,250
Bermuda.....	515	150	1,948
Carpet.....	519	115	1,602
Centipede ³	526	193	1,534
Mixture.....	519	156	2,103

¹ The average grazing season was from Mar. 20 to Nov. 18, or an average period of 243 days.

² Clipped about 10 times per year.

³ 4-year average, 1930–33. The 4-year average results from the other 4 plots were as follows: Gain per steer: Bahia, 158 pounds; Bermuda, 143 pounds; carpet, 99 pounds; mixture, 143 pounds. Yield of oven-dry grass per acre: Bahia, 2,249 pounds; Bermuda, 1,927 pounds; carpet, 1,851 pounds; mixture, 2,157 pounds. Calculated by the Southern Division, A. A. A.

RITCHEY, G. E., and HENLEY, W. W. Pasture value of different grasses alone and in mixture. Fla. Agr. Expt. Sta. Bul. 289, 28 pp., illus. 1936. See pp. 5, 7–11, 13, 17–23, 26.

Carrying capacity and forage value of pasture grasses. Fla. Agr. Expt. Sta. Ann. Rept., 211 pp., illus. 1933. See pp. 31–32.

RITCHEY, G. E., and STOKES, W. E. Correspondence with H. H. Hume, Asst. Dir. Res., Fla. Agr. Expt. Sta., Gainesville, Fla., June 15, 1937.

EXPERIMENT C

Conducted by: Florida Agricultural Experiment Station.

Conducted at: Gainesville.

Period: 1928, 1929.

Purpose: To determine the effect of various soil and plant treatments on the growth behavior and composition of four Florida pasture grasses, and to determine at which stage the grasses attain the best possible growth and composition under grazing conditions.

The phase presented here shows the results in terms of growth, or dry weight yields, only.

Land history: The experimental area had been cleared for 10 years, during which time it was used as a grass introduction and trial garden.

Soil: The soil was a Norfolk fine sand. The land was level.

Procedure and conditions: All plots in the experiment were 50 by 5 feet, or $\frac{1}{174}$ acre. The Bahia and carpet grass plots were sown in 1924, the centipede grass plot in 1926, and the Sudan grass in 1928. Seed was sown broadcast. All fertilizers were broadcast by hand. In the spring of 1928, eight plots of Bahia grass were divided into two series of four plots each. In one series the top growth was cut frequently, whereas in the other series the grass was allowed to grow to maturity and was then cut in the late seed stage. The various plots in each series were treated as follows: (1) 1,600 pounds per acre nitrate of soda and water; (2) 1,600 pounds per acre nitrate of soda; (3) water; and (4) no treatment.

Three plots of carpet grass and three of centipede grass were similarly divided into two series of three plots each and treated as follows: (1) 1,600 pounds per acre nitrate of soda and water; (2) water; and (3) no treatment. The nitrate of soda applied to the fertilized plots was proportioned and applied at monthly intervals over a period of 9 months during the growing season.

Two plots of Bahia grass and two of Sudan grass were also similarly divided into two series, each series containing one plot of each grass. The treatments were as follows: (1) One Sudan grass plot fertilized at the rate of 400 pounds per acre of nitrate of soda in three monthly applications and treated with water; (2) one plot of Bahia grass fertilized at the rate of 2,800 pounds per acre of nitrate of soda in seven monthly applications and treated with water; (3) the other two plots, one of each grass, were treated only with water. These last four plots were cut frequently throughout the growing season, i. e., whenever they attained a height suitable for grazing purposes.

Water was applied to the "water" plots and "nitrate of soda and water" plots at such intervals as to make soil nutrients available to the plants at all times. The other plots received moisture only through seasonal rainfall. The experiment was conducted on different plots each year.

Dry weight records of all top cuttings were kept in each instance.

Miscellaneous: The springs and falls were rather dry; from the middle of June to the middle of August the weather was rainy.

Results: Frequently cut plants when fertilized with nitrate of soda produced a more vigorous vegetative top growth than plants not fertilized. They were of a dark green color characteristic of plants in a very young vegetative growth stage. Plants not fertilized appeared to be slightly advanced in maturity, i. e., they were of a lighter green color, appeared less succulent, and did not produce such an abundance of vegetation.

Unlike the frequently cut Bahia plants, those not cut during the growing season produced a less dense sod because nearly all of the growing stolons for the production of seed were upright. This condition resulted in vacant spaces between the plants.

Additional results are given in table 15.

TABLE 15.—Yield of dry matter per acre from several pasture grasses variously treated and fertilized, Gainesville, Fla., 1928, 1929

1928					
Grasses	Cuttings	Yield of dry matter per acre ¹			
		No treat- ment	Water and 1,600 pounds nitrate of soda	1,600 pounds nitrate of soda	Water
	Number	Pounds	Pounds	Pounds	Pounds
Bahia.....	10	890	1,875	1,742	963
Do.....	² 3	1,664	4,842	4,825	1,704
Carpet.....	10	851	1,634	-----	1,018
Centipede.....	10	617	1,460	-----	822
1929					
Grasses	Cuttings	Yield of dry matter per acre ¹			
		Water and 400 pounds nitrate of soda	Water and 2,800 pounds nitrate of soda	Water	
	Number	Pounds	Pounds	Pounds	
Bahia.....	13	-----	4,767	-----	990
Sudan.....	³ 4	1,777	-----	-----	247

¹ Calculated by the Southern Division, A. A. A. (Converted from grams per plot to pounds per acre.)

² Cut in the seed stage and aftergrowth.

³ After 4 cuttings Sudan grass ceased to produce new growth, and work on this plot was discontinued.

LEUKEL, W. A., CAMP, J. P., and COLEMAN, J. M. Effect of frequent cutting and nitrate fertilization on the growth behavior and relative composition of pasture grasses. Fla. Agr. Expt. Sta. Bul. 269, 48 pp., illus. 1934. See pp. 3, 7-11, 16-18.

LEUKEL, W. A., and STOKES, W. E. Correspondence with H. H. Hume, Asst. Dir. Res., Fla. Agr. Expt. Sta., Gainesville, Fla., June 15, 1937.

OKLAHOMA

Conducted by: Oklahoma Panhandle Agricultural Experiment Station.

Conducted at: Goodwell.

Period: 1928-31.

Purpose: To determine the relative value of native and tame grass pastures.³

Soil: The soil was typical of the High Plains and very uniform.

Procedure and conditions: The native grass pasture consisted of 10 acres of uniform buffalo and grama grass sod. Five-acre areas were used for the Sudan and sweetclover pastures. The pastures were not grazed during the winter or early spring months. The experiment was conducted on the same land each year.

Sudan grass was planted on May 18, 1928, in 16-inch rows, on land that had been double disked and then leveled somewhat with a spike-tooth harrow. In 1929 it was again planted about the middle of May, in 16-inch rows, and harrowed once to check weeds. The

³ Although this experiment does not have the type of check area found in the other experiments, it has been included because it is believed to be representative of conditions in Oklahoma.

area had been plowed once during the preceding winter because it had become hard from tramping. In 1930 Sudan was planted on May 5 and 6. On May 10 a hard north wind blew dust on the area from a neighboring field to a depth of $\frac{1}{2}$ to 2 inches. On May 19 the pasture was replanted, but a poor stand was secured and weeds made quite a headway. The grass stand was quite good where the blow soil had not been deposited.

The sweetclover pasture was prepared and sown in the same way as was the Sudan plot each year. A good stand was not secured until 1930.

On July 8, 1928, the experiment was started with four Holstein heifers, two yearlings, and two heifers not quite 2 years old. One of the yearlings and one of the 2-year-olds were put on each plot of native grass and Sudan grass, respectively. On July 30 two heifers nearly 3 years old were turned in on the Sudan grass plot because the growth was becoming too rank. They were larger than the other heifers but of similar type. All the heifers were taken off pasture on October 1, 1928.

In 1929 the experiment was started on June 14 with six yearling Holstein heifers, two on each plot (including sweetclover). One month later the two heifers were removed from the sweetclover plot because the clover had become too short. On September 2 these two heifers were placed on the Sudan grass pasture where they remained until September 28. On August 1 a mature dry cow was added to the Sudan plot, which was becoming too rank, where it remained until August 21. All of the heifers were taken off the pastures on September 28, because the Sudan grass was short.

In 1930, the stock used was purebred Holstein heifers varying in age from 6 to 18 months. It was necessary during the trial to have different numbers of animals on the plots, thus making a balance in size almost impossible. On May 26 three heifers were placed on the sweetclover pasture and on June 7 two more heifers were added. On June 26 one heifer was removed and on July 23 two more were removed. The heifers were removed from the sweetclover pasture on August 7. On June 7 three heifers were placed on native grass pasture. The smallest calf had to be removed shortly afterward, leaving two on the plot. These were removed from the pasture on August 11. Two heifers were on the Sudan grass plot from July 14 to August 11.

In 1931 purebred Holstein heifers, varying in age from 12 to 18 months, were used. Two heifers were on the native grass pasture from June 6 to September 13. The Sudan grass, which got a poor start because of excessive weed growth, was grazed from July 6 to September 13 by three heifers.

Each year the animals used were related, of similar type, and in about the same condition, except in 1930 as mentioned above. The heifers were weighed on 3 successive days at the beginning and end of each test and the average weights in each case used as the initial and final weights, respectively.

The total rainfall during the pasture season each year was as follows: 1928, 5.74 inches; 1929, 9.33 inches; 1930, 11.73 inches; 1931, 5.86 inches.

Results: Given in table 16.

TABLE 16.—Gains made by heifers on native and on tame grass pastures, Goodwell, Okla., 1928-31¹

Year, type of pasture, age of cattle ²	Days on pasture	Initial weight per head	Gain or loss per head	Year, type of pasture, age of cattle ²	Days on pasture	Initial weight per head	Gain or loss per head
1928				1930			
Native grass:	<i>Number</i>	<i>Pounds</i>	<i>Pounds</i>	Native grass:	<i>Number</i>	<i>Pounds</i>	<i>Pounds</i>
Yearling.....	86	991	50	6-18 months.....	62	988	67
2-year-old.....	86	768	27	Do.....	62	855	85
Average.....	86	880	38	Average.....	62	922	76
Sudan grass:				Sudan grass:			
Yearling.....	86	912	215	6-18 months.....	26	1,228	-96
2-year-old.....	86	728	135	Do.....	26	973	7
3-year-old.....	³ 64	1,237	177	Average.....	26	1,100	-44
Do.....	³ 64	1,137	182	Sweetclover:			
Average.....	75	1,004	177	6-18 months.....	72	1,017	-33
1929				Do.....	⁶ 47	745	45
Native grass:				Do.....	72	332	58
Yearling.....	106	1,068	45	Do.....	⁶ 47	1,258	27
Do.....	106	605	68	Do.....	30	912	3
Average.....	106	836	56	Average.....	54	853	20
Sudan grass:				1931			
Yearling.....	106	770	160	Native grass:			
Do.....	106	730	140	12-18 months.....	99	708	107
Do.....	⁴ 24	898	20	Do.....	99	640	78
Do.....	⁴ 24	725	15	Average.....	99	674	92
Mature cow.....	⁵ 20	1,495	20	Sudan grass:			
Average.....	56	924	71	12-18 months.....	69	808	122
				Do.....	69	623	113
				Do.....	69	620	145
				Average.....	69	684	127

¹ Results in each case represent 1 animal.² The native grass pasture was 10 acres in area and the Sudan and sweetclover pastures were each 5 acres in area.³ Placed on pasture when Sudan grass became too rank.⁴ Taken from the sweetclover pasture.⁵ Mature dry cow put on Sudan grass, which was becoming too rank.⁶ Calculated by the Southern Division, A. A. A. Given in Bulletin 27 as 57 days.

WILLIAM, O. S. Sudan versus native grass, 1928. Okla. Panhandle Agr. Expt. Sta. Bul. 3, 14 pp. 1929. See pp. 3, 4.

WILLIAM, O. S. Tame versus native pastures, 1929. Okla. Panhandle Agr. Expt. Sta. Bul. 15, 19 pp. 1930. See pp. 3, 4.

WILLIAM, O. S. Tame versus native pastures, 1930. Okla. Panhandle Agr. Expt. Sta. Bul. 27, 16 pp. 1931. See pp. 3, 4, 6.

JACOBS, E. E. Tame versus native pastures, 1931. Okla. Panhandle Agr. Expt. Sta. Bul. 35, 12 pp. 1932. See pp. 8-12.

TENNESSEE

Conducted by: Tennessee Agricultural Experiment Station, Knoxville.**Conducted at:** Middle Tennessee Station, Columbia.**Period:** 1927-33.**Purpose:** To determine the possibility of eradicating broomsedge through pasturing and the use of legumes.**Soil:** The soil was a brown Maury silt loam, rich in phosphate. The land had a 3-percent slope and had lost about 9 inches of soil.**Land history:** The land had been cleared about 75 or 100 years. It had been largely in corn, wheat, clover or grass, or both, with occasional crops of oats, until about 5 years previous to this experiment, when it was in cotton and winter cover crops part of the time. Corn yields were about 25 bushels per acre, and wheat about 12 bushels per acre.

Procedure and conditions: Early in 1927 an area was well prepared and seeded to broomsedge in order to produce a stand upon which control measures might be practiced. A good stand was secured. About March 1, 1928, the land was disked, harrowed, and seeded to 14 pounds of bluegrass and 2 pounds of white clover per acre. At the same time, the area was divided into four plots, each three-sixteenths of an acre. Common lespedeza was sown on one plot at the rate of 20 pounds per acre, hop clover at the rate of 5 pounds per acre on another, and sweetclover at the rate of 15 pounds per acre on a third. The seed was not covered. The fourth plot was left as a check, and had only bluegrass and white clover as companion crops. The white clover, however, never became well enough established to be an important factor on any of the pastures. One-half of each plot was limed at the rate of 2 tons of ground limestone per acre. The same land was used each year of the experiment. None of the pastures were clipped.

In 1929 pasturing with yearling Hereford steers, averaging 525 pounds each, was begun. The steers had been wintered well and then pastured on other lands to accustom them to fresh pasture. They were placed on the experimental area as soon as the grass was long enough and allowed to remain there until the grass had been grazed fairly closely. When the grass had grown in again, the procedure was repeated. The steers did not receive supplementary feed.

Miscellaneous: It was found difficult to maintain a stand of sweetclover, and the practices followed to encourage seeding curtailed pasturing. Hop clover was allowed to produce plenty of seed without materially reducing the amount of pasturage secured.

The years 1928 and 1929 were excellent for grass, 1930 and 1931 were very dry, 1932 was fair, 1934 was a very poor pasture year, and 1933 was a good pasture year.

Results: Lime had little effect on the sweetclover.

The average number of cow-days per acre secured from the various plots was as follows: Check plot, 141 days; lespedeza, 149 days; hop clover, 179 days; and sweetclover, 121 days.

Additional results are given in table 17.

TABLE 17.—*Effect of pasturing and the use of legumes on the percentage of broomsedge and of bluegrass and clovers, on the basis of 100 percent for a full stand, Columbia, Tenn., 1928, 1930, 1932, and 1933*

Year ¹	Percentage of—							
	Broomsedge on—				Bluegrass and clovers on—			
	Check plot	Lespe-deza plot	Hop clover plot	Sweet-clover plot	Check plot	Lespe-deza plot	Hop clover plot	Sweet-clover plot
1928.....	83	83	83	83	17	17	17	17
1930.....	35	25	30	20	30	30	50	37
1932.....	35	25	11	17	50	60	75	60
1933.....	35	20	5	15	65	80	90	80

¹ Records were made only during the years listed.

NEEL, L. R. Control of broomsedge. Tenn. Agr. Expt. Sta. Cir. 57, [4]pp. 1936. See pp. 1, 2.
 NEEL, L. R. Studies in sedge-grass control. Assoc. Sou. Agr. Workers, Proc. 37th Ann. Conv. (1936), 208 pp. 1937. See pp. 18, 19.
 NEEL, L. R., Supt. Middle Tenn. Sta., Columbia, Tenn. Correspondence of Feb. 9, 1938.
 MOORE, C. A., Dir. Tenn. Agr. Expt. Sta., Knoxville, Tenn. Correspondence of May 27, 1938.

TEXAS

EXPERIMENT A

Conducted by: Texas Agricultural Experiment Station, College Station.

Conducted at: Angleton.

Period: 1934-37.

Purpose: To compare native and improved pasture for fattening steers.

Land history: The area was natural prairie land which had been a native hay meadow for a number of years previous to being plowed and seeded to improved pasture grasses.

Soil: The soil was Lake Charles clay loam and Edna very fine sandy loam with salt spots. The land was almost level, with fair but slow drainage, and was not eroded.

Procedure and conditions: The improved pasture consisted of about an equal mixture of Dallis, Bermuda, and carpet grasses with some Angleton grass and volunteer native grasses. Lespedeza and white Dutch clover were also present. In the spring of 1931 the land was flat-broken, disked, then the seed was broadcast and harrowed in. No fertilizer was applied.

The native pasture consisted largely of little bluestem with some big bluestem, bushy bluestem, a small amount of carpet and Bermuda grasses, and a considerable amount of native weeds such as milkweed, ragweed, myrtle bushes, and sulphur weed.

The same pastures were used each year.

Seven steers were grazed on 17.5 acres of improved permanent pasture without supplementary feed, while 7 other steers which were grazed on 17.5 acres of native pasture required a supplement of prairie hay from January to March each year.

TABLE 18.—*Gains made by steers on improved and native pastures, Angleton, Tex., 1934-37*

Item	Improved pasture	Native pasture
Steers per lot.....number.....	7	7
Total days grazing.....do.....	1,305	1,154
Average initial weight.....pounds.....	485	485
Total gain per steer.....do.....	525	353
4-year average gain per steer ¹do.....	131	90
Sale price per 100 pounds ²dollars.....	6.25	6.35

¹ Calculated by the Southern Division, A. A. A.

² Steers on native pasture were sold in June 1937 and those on improved pasture were sold in November 1937. The market price on medium to common grade steers was from \$1.50 to \$2 per hundred pounds lower on Nov. 15, 1937, than on June 16, 1937.

A study of native and improved pastures in the Gulf Coast Prairie Substation, No. 3, Angleton, Tex. Tex. Agr. Expt. Sta. Ann. Rept., 294 pp. 1935. See p. 40.

REYNOLDS, E. B., Chief, Div. of Agron., Tex. Agr. Expt. Sta., College Station, Tex. Correspondence of June 3, 1938.

The cattle were grade Hereford yearling steers at the beginning of the experiment, and were in fair range condition. They were pastured continuously throughout the year. A shed was provided in each pasture.

Results: Steers on improved pasture gained slowly in the spring but continued to gain until frost. Those on native pasture stopped gaining about June 1. Steers on improved pasture went through the winters in much better condition and in 1937 were about 200 pounds heavier.

Additional results given in table 18.

EXPERIMENT B

Conducted by: Texas Agricultural Experiment Station, College Station.

Conducted at: Beaumont.

Period: 1932-34.

Purpose: To compare various pasture plants and pasture plant mixtures.

Land history: The area was originally prairie land which had never been in timber. It was cropped to rice (every second or third year) or in pasture beginning in 1909.

Soil: The soil was a Crowley clay. The land was poorly drained, sloped 6 inches per mile, but was not eroded.

Procedure and conditions: The experiment consisted of 4 series of 26 plots each. Plots were 100 square feet in size and were separated by 2-foot alleys. The same plots were used each year. Seedings of pasture plants, alone or in mixtures, were made. Seed was sown on top of the soil and dragged lightly with a drag harrow. The spring sown crops were planted on April 2, 1931, and the fall sown crops were planted on October 3, 1931.

Clippings were made with a lawn mower at approximately 1-month intervals from February to October, inclusive.

Miscellaneous: The annual rainfall averaged 53 inches, except in 1932, when only 41.10 inches fell and a dry season resulted.

Results: By the end of 1934, Bermuda, carpet, and Dallis grasses, lespedeza, and white clover had spread to all of the plots irrespective of the original treatment or mixture.

Additional results for six of the tests are given in table 19.

TABLE 19.—Average yield of air-dry forage per acre from various pasture plots, Beaumont, Tex., 1932-34

Pasture plants	3-year average yield of air-dry forage per acre	Pasture plants	3-year average yield of air-dry forage per acre
	<i>Ton</i>		<i>Ton</i>
Carpet grass.....	0.70	Dallis grass.....	0.75
Dallis grass.....	.75	Bermuda grass.....	
Bermuda grass.....	.71	Carpet grass.....	
Bermuda grass.....	.66	Dallis grass.....	.70
Lespedeza.....		Lespedeza.....	
Rescue grass.....		Rescue grass.....	
White clover.....		White clover.....	

Pasture improvement and management in east Texas. Tex. Agr. Expt. Sta. Ann. Rept., 294 pp. 1935. See pp. 64, 65.

REYNOLDS, E. B., Chief, Div. of Agron., Tex. Agr. Expt. Sta., College Station, Tex. Correspondence of June 3, 1938.

Comparative Improvement in Pasture Through Fertilizing and Liming—Results in Terms of Cattle Gains⁴

ARKANSAS

Conducted by: Arkansas Agricultural Experiment Station, Fayetteville.

Conducted at: Cotton Branch Station, Marianna.

Period: 1927–33.

Purpose: To compare gains made by cattle on fertilized and on unfertilized pasture.

Land history: The land had been in cotton and an occasional crop of corn for 65 years, without cover crops or fertilizers. It had been abandoned as unprofitable for farming.

Soil: The soil was a silty and clayey loam, classified as Lintonia silt loam. The land was submarginal; half the area was severely eroded and one-third was poorly drained. The average degree of slope was $4\frac{1}{2}$ percent.

Procedure and conditions: In 1927 the establishment of a permanent pasture on the area was begun. Prior to this time seedings of common grasses and legumes had failed to give favorable results. The land was plowed (broken) in early spring and prepared for planting. Furrows 5 to 6 inches deep and 2 to 3 feet apart were opened. In these, pieces of Bermuda sod were dropped about 2 feet apart, and covered. The surface was then smoothed and seed of carpet grass, Dallis grass, and other grasses, and also white clover and hop clover (light seeding) were sown on the surface as early in spring as practicable. Lespedeza seed was sown at the rate of 8 pounds per acre in late March or early April, and bur-clover seed was sown at the rate of 1 bushel per acre in July or August for early fall germination. When necessary, hop clover and white clover seed were sown at the rate of 5 pounds each per acre, usually in September. If a satisfactory stand of lespedeza did not result from the first seeding, a second seeding was made a year later. These seedings were made on the surface and the soil was not cultivated after the Bermuda had been set.

Weeds and tall growth were cut with a mowing machine when necessary, usually about May 15 and occasionally in August or September. Grazing stock were excluded from the area as much as possible. Occasional touching up of thin spots was necessary during the next 2 years.

In 1930 grazing studies were begun on the pasture land. Two areas of 3.3 acres each were fenced, and provided with shade, salt, and water. One area was fertilized with nitrate of soda, the other was left unfertilized. The experiment was conducted on the same land continuously.

Grade Shorthorn and Hereford steers ranging in age from 12 to 18 months, lean, but of fair quality and weighing approximately 350 pounds, were used on the pastures. They had been kept and fed as usual, chiefly on roughages, prior to being used in the experiment. The cattle were divided as evenly as possible between the two

⁴ See also tables Nos. 13 and 26.

areas, on the basis of types and weights. They were kept on pasture continuously and weighed individually on the 1st and 16th of each month during the grazing season.

During the grazing season the number of animals on the pasture was varied as necessary. In dry periods the numbers were reduced, and when rains improved the pasture growth animals were restored in proportion to the improvement made so as to maintain a desirable balance between the pasturage available and the number of animals. During the early part of the season when the growth of legumes was greatest, the fertilized pasture stocked at the rate of nearly four head per acre. An average of 417 grazing days per year was secured on the fertilized pasture and 316 days on the unfertilized pasture. The cattle received no other feed. When stock was taken off or returned to pastures, the usual weighings were taken before the change was made.

The same cattle were used in 1931, but were re-grouped. High grade yearling Hereford steers were used in 1932 and 1933 (not the same animals both years, however).

The grazing period each year extended approximately from early April to November 1.

Miscellaneous: A severe drought occurred late in the 1930 season. The 1931 season was more favorable, and the 1932 and 1933 seasons were about average.

Results: No marked differences in the condition of the cattle on the fertilized and unfertilized pastures were apparent.

Additional results are given in table 20.

TABLE 20.—Gains made by cattle on fertilized and on unfertilized pasture, Marianna, Ark., 1930–33¹

Date of taking weights	4-year average gain per acre of all cattle on—		Date of taking weights	4-year average gain per acre of all cattle on—	
	Fertilized pasture	Unfertilized pasture		Fertilized pasture	Unfertilized pasture
	<i>Pounds</i>	<i>Pounds</i>		<i>Pounds</i>	<i>Pounds</i>
May 1 ²	³ 218	³ 166	Aug. 16.....	91	55
May 16.....	346	272	Sept. 1.....	5	27
June 1.....	186	172	Sept. 16.....	—44	—87
June 16.....	255	198	Oct. 1.....	1	36
July 1.....	51	16			
July 16.....	—52	—45	Average gain per acre....	334	248
Aug. 1.....	47	10			

¹ In 1930 nitrate of soda was broadcast on the surface in the spring, and again in June, at the rate of 75 pounds per acre.

² Cattle placed on pasture in early April.

³ 3-year average, 1930, 1931, and 1933. Grazing not begun until May 5 in 1932.

NELSON, M. Permanent pastures. Ark. Agr. Expt. Sta. Bul. 307, 18 pp., illus. 1934. See pp. 6, 7, 9–11, 13.

NELSON, M. Agron., Ark. Agr. Expt. Sta., Fayetteville, Ark. Correspondence of Aug. 1, 1937.

GEORGIA

Conducted by: Georgia Coastal Plain Agricultural Experiment Station, in cooperation with the Division of Forage Crops and Diseases, Bureau of Plant Industry, and the Animal Husbandry Di-

vision, Bureau of Animal Industry, of the United States Department of Agriculture.

Conducted at: Tifton.

Period: 1929-36.

Purpose: To determine the carrying capacity and fertilizer requirements (in terms of cattle gains and grass yields) of improved lowland and upland pastures seeded to various grasses and legumes.

Land history: The lowland area was originally covered with a dense swamp growth consisting of pine, black gum, poplar, gallberries, groundsel, briars, and wiregrass. Clearing, stumping, and draining by open and tile ditches were begun in 1926. In addition to a center ditch for the main stream, lateral ditches were dug more or less parallel to the main stream to cut off seepage from the upland. In 1926 only the carpet grass-lespedeza pasture, later to be used as a check or unfertilized area, was completed. In 1928 and 1929 this work was continued north of and adjoining the original area, and in the spring of 1929 four more pastures were seeded with a mixture of 8 pounds of carpet grass, 3 pounds of Dallis grass, 10 pounds of lespedeza, and 3 pounds of white clover per acre. Plantings were broadcast by hand in the early spring after the land had been thoroughly prepared by plowing or disking and harrowing.

The upland area had been cleared for 25 or 30 years previous to the experiment. During this period it had been cropped to cotton, corn, peanuts, and oats. For 5 or 6 years preceding the experiment two crops of winter peas were turned under. Cotton grown during this period was fertilized with 400 pounds of 3-9-5 (NPK), and yielded from 600 to 800 pounds of seed cotton per acre.

Soil: The lowland soil was mostly Plummer sandy loam, bordering on Norfolk sandy loam; the land sloped gently. The upland soil was fairly moist Tifton sandy loam; the land was gently rolling. There was little erosion on either area.

Procedure and conditions: The experiment consisted of 10 pastures. Nos. 1 to 5 were on the lowland area, Nos. 6 to 10 on the upland area. The phase reported here deals only with permanent pastures, so results secured on pastures 9 and 10 (temporary pastures) are not given.

Each of the five lowland pastures was 6 acres in area, with the exception of pasture 5 which was only $3\frac{1}{2}$ acres.

Although the fertilizer applications indicated in table 21 were applied the first year [1929], no grazing was possible for lack of fence. Grazing was begun in May 1930, but records were kept for the carpet grass-lespedeza (check) area, only. Pastures were gone over and reseedings made on bare spots. In 1931 grazing began in June. In 1932 grazing was delayed until May 1 in order to allow white clover to produce seed and become better established. In succeeding years grazing was begun about April 1.

Fertilizer was applied annually to the lowland pastures at the rate of 600 pounds per acre in the ratios indicated in table 21. All of the superphosphate and potash and one-half of the nitrogen were applied about the middle of March; the other half of the nitrogen was applied about July 20. In 1936, however, nitrate of soda only, was applied to pastures 2, 3, and 4; and pasture 5 as well as pasture 1 (check) remained unfertilized, the plan being to apply nitrogen

every year thereafter, but superphosphate and potash only every fourth year.

The upland pastures were prepared by turning with a two-horse plow. The centipede-lespedeza areas (pastures 6 and 7) were established by setting small blocks of centipede grass in 2-foot rows and by sowing the lespedeza broadcast. The grazing area on pasture 6 varied from year to year. (See table 22.) This pasture remained unfertilized. Pasture 7, which was 4 acres in area, was fertilized with 400 pounds of 6-12-6 (NPK) per acre, applied annually in the spring.

On the Bermuda-lespedeza area (pasture 8) the Bermuda sod was established by setting runners in 3-foot rows. Lespedeza was sown broadcast. This pasture was 12 acres in area. In order to prevent the grass from becoming sod-bound, one-half of the pasture was turned about March (before the lespedeza germinated) each year. The plow was set so as to turn the furrow slice on edge so that the lespedeza seed would not be covered too deeply. Before the spring of 1936 this area had remained unfertilized. At that time it received 600 pounds of 6-12-6 (NPK) per acre. The area was, thereafter, to receive phosphorus and potash every fourth year, and nitrogen every year, one-half in the spring, one-half in the summer.

Seed was not covered when sown on any of the pastures.

A good grade of Hereford steers, between 1 and 2 years old, and as uniform in size and type as could be obtained, were used on both lowland and upland pastures. The animals were neither poor nor fat but in fair range condition, having been carried on a maintenance test during the previous 60 to 90 days. The steers remained on pasture constantly during the experiment, and were weighed every 28 days during the grazing period.

Grazing periods for each year were as follows: June 2 to November 17, 1931; April 30 to November 14, 1932; April 4 to November 14, 1933 (except pasture 6, where grazing ended October 16); April 4 to November 13, 1934 (except pasture 7, where grazing began May 2); April 3 to November 5, 1935; April 8 to November 11, 1936.

A mineral mixture composed of 40 percent ground limestone, 40 percent ground bonemeal, and 20 percent salt was kept before the steers at all times. Less than 20 pounds was consumed per animal per year. Clear water was provided on all pastures. No shelter was provided for steers on lowland pastures but an open shed was used on upland pastures.

When pastures appeared to be over-grazed, animals were taken out; when apparently not being grazed enough, steers were added to give a proper balance. Under these circumstances weights were taken and the pasture given credit for the gain or loss. Pastures were mowed one to three times a season to keep down undesirable weeds.

On fertilized pastures all of the superphosphate and potash and one-half of the nitrogen were put on about the middle of March about 10 days to 2 weeks before putting the animals on pasture. The other half of the nitrogen was applied as a top dressing around

July 20. When summer applications were made, the fertilizer was finely ground and evenly scattered in order to prevent the animals from getting enough to become poisoned. Animals were not removed from the pasture while it was being fertilized.

Forage yields on all plots were determined by making clippings on protected plots, 1 rod square, which were moved to new locations on the pastures every 28 days during the grazing period from 1934–36, inclusive. On being located each time, the plots were mowed before the fence was set up. Plot locations were selected at random.

Miscellaneous: Lespedeza gave way steadily on pastures 2 and 3 after 1933, and white clover spread each year until it was finally over both of these pastures. Lespedeza tended to become thin on pasture 5 after 1935. White clover on pastures 4 and 5 was less vigorous than on pastures 2 and 3, and on pasture 4 it finally almost disappeared.

The 6-year (1930–36) average rainfall for the period March 1 through October 31, was 32.10 inches, and the average annual rainfall for the 6-year period was 43.59 inches. The greatest deviation from average was in 1931, when the total rainfall March 1 through October 31 was 26.39 inches, and the annual rainfall was 34.41 inches.

Later data indicated that better stand and quicker sod were secured on the lowland area by planting a mixture of 10 pounds of carpet grass, 8 pounds of Dallis grass, 12 pounds of common lespedeza, and 5 pounds of white clover, per acre, than by using the mixture seeded in 1929 on that area.

Results: For lowland pastures given in table 21, for upland given in table 22.

TABLE 21.—*Lowland pasture: Average weights and gains of steers and green weight yields of grasses on lowland pastures variously fertilized, Tifton, Ga., 1930–36*¹

PASTURE 1—CARPET GRASS² (6 ACRES)

Item	Unfertilized					
	1931	1932	1933	1934	1936	5-year average
Steers grazed.....number.....	4	4	5	6	5	4.8
Average initial weight.....pounds.....	443	580	413	389	479	454
Average gain per steer.....do.....	75	94	101	91	67	86
Average green weight yield per acre ³do.....				5,942	8,654	⁴ 7,298

PASTURE 2—MIXTURE (6 ACRES)

Item	Fertilized (6-12-6)					(6-0-0)
	1931	1932	1933	1934	1935	5-year average 1936
Steers grazed.....number.....	5	5	7	9	9	7
Average initial weight.....pounds.....	472	579	420	451	432	461
Average gain per steer.....do.....	204	279	264	199	295	249
Average green weight yield per acre ³do.....				15,080	15,193	⁴ 15,136
						18,323

See footnotes on following page.

TABLE 21.—Lowland pasture: Average weights and gains of steers and green weight yields of grasses on lowland pastures variously fertilized, Tifton, Ga., 1930-36¹—Continued

PASTURE 3—MIXTURE (6 ACRES)

Item	Fertilized (6-12-0)						(6-0-0)
	1931	1932	1933	1934	1935	5-year average	1936
Steers grazed.....number..	5	5	7	8	9	6.8	9
Average initial weight.....pounds..	473	573	421	382	421	442	511
Average gain per steer.....do.....	149	261	231	217	272	231	147
Average green weight yield per acre ²do.....				14,661	13,976	14,318	15,061

PASTURE 4—MIXTURE (6 ACRES)

Item	Fertilized (6-0-0)						6-year average
	1931 ³	1932	1933	1934	1935	1936	
Steers grazed.....number..	5	5	7	8	6	6	6.2
Average initial weight.....pounds..	467	587	416	411	411	532	463
Average gain per steer.....do.....	111	188	138	79	249	103	141
Average green weight yield per acre ²do.....				9,320	5,743	8,278	67,780

PASTURE 5—MIXTURE (3.5 ACRES)

Item	Fertilized (0-0-6)						Unfertilized
	1931	1932	1933	1934	1935	5-year average	1936
Steers grazed.....number..	3	3	4	4	4	3.6	4
Average initial weight.....pounds..	395	592	409	413	432	443	472
Average gain per steer.....do.....	154	192	108	114	206	153	120
Average green weight yield per acre ²do.....				7,074	8,188	7,631	10,597

¹ Fertilizers are expressed in ammonia, phosphoric acid, and muriate of potash (NPK) in the order named. Mixture on pastures 2, 3, 4, and 5 consisted of carpet grass, Dallis grass, common lespedeza, and white clover. Averages weighted by the Southern Division, A. A. A.

² Lespedeza practically choked out by dense carpet grass sod after 1931. This pasture was grazed in 1930 but since the other plots were not grazed that year the results are not included here. Results for 1935 not obtained because part of the pasture was plowed to destroy sedges and wiregrass.

³ From clippings.

⁴ 2-year average.

⁵ 1 animal died and another was added during this period.

⁶ 3-year average.

TABLE 22.—Upland pastures: Average weights and gains of steers, and green weight yield of grasses on pastures variously fertilized, Tifton, Ga., 1930-36¹

PASTURE 6—CENTIPEDE GRASS AND LESPEDEZA²

Item	Unfertilized				
	1931	1932	1933	1934	4-year average ³
Area of pasture.....acres..	5	4 17	12	7	10
Steers grazed.....number..	2	7	5	2	4.0
Average initial weight.....pounds..	457	451	386	437	430
Average gain or loss per steer.....do.....	39	138	-29	-24	53
Average green weight yield per acre ⁴do.....				1,982	(⁵)

See footnotes on following page.

TABLE 22.—*Upland pastures: Average weights and gains of steers, and green weight yield of grasses on pasture variously fertilized, Tifton, Ga., 1930-36*¹—Continued

PASTURE 7—CENTIPEDE GRASS AND LESPEDEZA

Item	Fertilized (6-12-6)			
	1934	1935	1936	3-year average ³
Area of pasture.....acres.....	4	4	4	4
Steers grazed.....number.....	2	3	3	2.7
Average initial weight.....pounds.....	481	429	409	440
Average gain per steer.....do.....	80	75	32	62
Average green weight yield per acre ⁵do.....	3,882	4,181	2,811	3,625

PASTURE 8—BERMUDA GRASS AND LESPEDEZA

Item	Unfertilized					(6-12-6)
	1932	1933	1934	1935	4-year average ³	1936
Area of pasture.....acres.....	12	12	12	12	12	10
Steers grazed.....number.....	5	8	10	9	8.0	6
Average initial weight.....pounds.....	407	412	444	457	434	510
Average gain per steer.....do.....	309	175	72	178	165	219
Average green weight yield per acre ⁵do.....			3,156	4,652	73,904	8,666

¹ Fertilizers are expressed in ammonia, phosphoric acid, and muriate of potash (NPK) in the order named. Fertilizer applied at rate of 400 pounds per acre on pasture 7 and 600 pounds per acre on pasture 8.

² A mixture of other plants was present in 1930 on pasture 6 before the centipede sod became well established. Results for this year are not included. Since each animal on this lot in 1935 and 1936 received daily 1 pound of cottonseed meal as supplementary feed, the results are not considered comparable with the other pastures and are not included.

³ Weighted averages, calculated by Southern Division, A. A. A.

⁴ 2 pastures of 5 and 12 acres, respectively. Results were averaged.

⁵ From clippings.

⁶ Yields for 1935 and 1936 were 1,943 pounds and 1,038 pounds per acre, respectively. The 3-year weighted average, 1934-36, was 1,626 pounds per acre.

⁷ 2-year average. The 3-year average, 1934-36, was 5,491 pounds per acre.

STEPHENS, J. L. Pastures for the Coastal Plain of Georgia. Through Dr. P. V. Cardon, Prin. Agron. in Chg., Div. Forage Crops and Diseases, Bur. Plant Indus., U. S. Dept. Agr. 1937. [Unpublished manuscript of Ga. Coastal Plain Bul. 27.]

Ga. Coastal Plain Expt. Sta. Ann. Rept. (1932), 105 pp., illus. 1933. See p. 53.

Ga. Coastal Plain Expt. Sta. Ann. Rept. (1933-34), 115 pp., illus. 1934. See pp. 49, 51, 53.

STEPHENS, J. L., in Chg., Forage crop and pasture project. Correspondence with S. H. STARR, Dir., Ga. Coastal Plain Expt. Sta., Tifton, Ga., July 3, 1937.

LOUISIANA

Conducted by: Louisiana Agricultural Experiment Station, Baton Rouge, and Southwestern Louisiana Institute, Lafayette, La.

Conducted at: Lafayette.

Period: 1929-36.

Purpose: To determine the effect of fertilizer and lime on grazing results, and on grass yields and composition. The phase dealing with the composition of grass is not included in this digest.

Land history: The area had been cleared for 50 years and had been in sugarcane and silage corn (with soybeans) for 3 years prior to the experiment.

Soil: The soil was Lintonia fine sand, which was slightly acid and somewhat low in fertility as a result of continuous cropping. The land was rolling prairie having a 1- to 2-percent slope, and so flat as to be poorly drained.

Procedure and conditions: The experiment was conducted for two 3-year periods from 1931 to 1936.

Pasture 3 (8 acres) was not grazed until 1934. However, in October 1929, it was disked thoroughly and seeded broadcast to white Dutch clover and domestic rye grass. Lespedeza was added in February of 1930. Bermuda, hop clover, annual yellow sweet-clover, bur-clover, Dallis, and carpet grass have come in since then. In March, 200 pounds each of nitrate of soda and superphosphate were added. In the late fall of 1930 the pasture was limed with 2 tons of crushed oyster shell (calcium carbonate) per acre. Rye grass was seeded again and the same rate of fertilization followed thereafter on pasture 3 except that 50 pounds of muriate of potash also were applied from 1934-36. One-half of the nitrate of soda was applied in the spring and the balance of the fertilizers were applied in the late fall. Lime was applied every 5 years.

Pasture 1 (4 acres) was treated similarly to pasture 3, but it was grazed for 6 years, 1931-36.

TABLE 23.—*Milk production and hay yield from limed, fertilized, and untreated pastures, Lafayette, La., 1931-36*

3-YEAR AVERAGE, 1931-33

Pasture No.	Treatment ¹	Yield per acre		Cow days per acre	Acres per cow ²
		4 percent milk	Dry matter		
Check	No lime, no fertilizer	<i>Pounds</i> 3,412	<i>Pounds</i> 7,528	<i>Number</i> 164	<i>Number</i>
1	(Nitrate of soda, 200 pounds	6,698	10,322	292	
	(Superphosphate, 200 pounds				
2 ³	(Cyanamide, 150 pounds	9,735	12,976	359	
	(Complete fertilizer, 150 pounds				

3-YEAR AVERAGE, 1934-36

Check	No lime, no fertilizer	4,834	6,933	233	0.93
1	(Nitrate of soda, 200 pounds	5,744	8,288	262	.83
	(Superphosphate, 200 pounds				
2	(Cyanamide, 150 pounds	6,924	8,485	290	.75
3 ⁴	(Complete fertilizer	4,750	8,353	228	.95
	(Lime (2 tons oyster shells)				

6-YEAR AVERAGE, 1931-36

Check	No lime, no fertilizer	4,123	7,510	198	1.09
1	(Nitrate of soda, 200 pounds	6,221	9,102	277	.78
	(Superphosphate, 200 pounds				
2	(Cyanamide, 150 pounds	8,048	10,545	318	.68
	(Complete fertilizer in 3 of 5 years ⁵				

¹ In the last 3 years, 1934-36, the formula for complete fertilizer was 8-9-8.

² On the basis of a 217-day grazing season.

³ 2-year average, 1932 and 1933. Not grazed in 1931.

⁴ Not grazed in 1931-33. Lime applied every 5 years. Complete fertilizer as follows: 200 pounds, each, nitrate of soda and superphosphate, and 50 pounds muriate of potash.

⁵ 5-year average. (See footnote 3.) Complete fertilizer applied from 1931-33.

LUSH, R. H., and FLETCHER, J. L. Pasture fertilization results. Jour. Dairy Sci., vol. 17, No. 11, pp. 701-757. 1934. See pp. 733-735.

LUSH, R. H., Dairy Husbandry, La. Agr. Expt. Sta., University, La. Correspondence and [mimeographed], Sept. 14, 1937.

LUSH, R. H., in charge Dairy Res., La. Agr. Expt. Sta., University, La. Correspondence of Feb. 5, 1938.

Pasture 2 was similar to 3 in that it was seeded in 1929, but it was treated with 150 pounds of cyanamide each year. A complete fertilizer was applied at the rate of 150 pounds in the 3 years 1931-33.

The check pasture in the first period was similar in establishment and vegetation to pasture 1, and in the last period it was similar to pasture 3.

Mature milking Jersey cows in excellent condition, weighing about 1,000 pounds each, were pastured in alternate periods. They were fed in the barn at the rate of about 1 pound of feed per 3 pounds of milk yield. The cows were grazed in alternate periods, and were added to or taken off the pasture as growth of grass warranted. Shade and water were provided.

Hay yields were obtained from caged areas which were mowed about March, June, and September of each year. Fertilizers were broadcast.

Miscellaneous: The seasons of 1930, 1934, and 1936 were dry.

Results: Given in table 23.

NORTH CAROLINA

Conducted by: North Carolina Agricultural Experiment Station, Raleigh, in cooperation with the Animal Husbandry Division of the United States Department of Agriculture, and a local farmer.

Conducted at: Jones County, N. C.

Period: 1932, 1933.

Purpose: To determine the value of fertilizing heavily grazed carpet grass and lespedeza pasture.

Land history: The land had been in corn, pasture, cotton, and tobacco, and during the 8 years immediately preceding this experiment it had been in pasture. It is deduced, from published material, that the land was in a low state of fertility when planted to pasture.

Procedure and conditions: A carpet grass and lespedeza pasture measuring 14.2 acres was divided into two areas of equal size. One of these was fertilized, and the other remained unfertilized and was used as a check.

TABLE 24.—*Gains made by cattle on unfertilized and fertilized carpet grass and lespedeza pasture, Jones County, N. C., 1933*

Treatment	Cattle	Days on pasture	Cattle days	Average gain per head ¹
Unfertilized.....	Number 8, 9	Number 182	Number 1, 615	Pounds 264
Fertilized ²	12, 2	182	2, 217	320

¹ Calculated by the Southern Division, A. A. A.

² 400 pounds of 4-8-4 per acre in the early spring of 1932, and again on Mar. 4, 1933.

CASE, L. I., Anim. Husb. Div., U. S. Dept. Agr. The value of fertilizing carpet grass pastures. Assoc. Sou. Agr. Workers, Proc. 35th Ann. Conv. (1934), pp. 157-345. See p. 265.

WINTERS, R. Y., Dir., N. C. Agr. Expt. Sta., Raleigh, N. C. Correspondence of Sept. 7, 1937.

One- and two-year-old grade Hereford cattle were turned on the pastures on April 26, 1933, where they grazed continuously until October 25. With the exception of the first month, weights were

taken every 14 days. Attempts to graze the pastures equally close often necessitated the addition or subtraction of cattle to or from one or both pastures.

Miscellaneous: The 1932 season was too dry to provide a comparison of any significance.

Results: At the end of the experiment the cattle were from medium to good grade.

Additional results are given in table 24.

SOUTH CAROLINA

Conducted by: South Carolina Agricultural Experiment Station, Clemson.

Conducted at: Clemson.

Period: 1933-35.

Purpose: To determine the grazing value of established Bermuda pasture and of carpet grass under three systems of fertilization.

Land history: For the 10 years previous to 1930, pastures 1 and 2 had been used for annual grazing crops; pearl millet was planted in the spring and a mixture of oats, rye, barley, and vetch in the fall. No fertilizer or manure was applied during this period. In February 1930 both of these pastures were plowed, and clumps of Bermuda roots were scattered over the surface at intervals of about 3 feet and harrowed into the soil with a disk harrow. These pastures were used very little in 1930 because a dry season prevented the development of a good sod. In May 1931, pastures 1 and 2 each received an application of 3,000 pounds of limestone per acre. They were grazed during 1931 and 1932 before the beginning of the experimental work in 1933.

Pastures 3 and 4 were old established Bermuda grass sods which had previously been part of the regular pasture of the dairy herd. In November 1932, pasture 3 received an application of 3,000 pounds of limestone per acre. Pasture 5 had also been a part of the regular dairy pasture before being fenced in the fall of 1933. It had been seeded to carpet grass in 1925, and was, at the time of fencing and throughout the 2 years it was used for experimental grazing, a 90 to 95 percent pure stand of carpet grass.

Soil: Pastures 1 to 4 were Cecil sandy clay loam; pasture 5 was Wehadkee sandy loam and was located on a low-lying, poorly drained, creek bottom.

Procedure and conditions: The five areas used for these studies were designated as pastures 1, 2, 3, 4, and 5. Pastures 1, 2, and 3 (Bermuda grass) were tested for the 3-year period, 1933-35. Pasture 4 (Bermuda grass), and pasture 5 (carpet grass), were tested during the 1934 and 1935 seasons. Each pasture was enclosed by a permanent fence of woven wire in order to maintain a definite net grazing area throughout the experiment.

Pasture 3 had been used previously by the dairy herd as a night bedding ground and in the fall of 1932 had an accumulation of manure equivalent to about 5 tons per acre. This was evenly distributed and was the only treatment on the area in 1933. The area was not grazed from November 1932 until the pasture season began in April 1933.

Amounts of fertilizer and dates of application for pastures 1, 2, 3, and 5 are given in table 25. Pasture 4 was not fertilized. All limestone and fertilizers were applied as surface treatments. Limestone was distributed with a grain drill which had fertilizer attachments. Superphosphate was broadcast by hand, and manure was distributed by means of a spreader.

In early November of 1933 and 1934, each pasture was harrowed both ways with a heavily weighted spring-tooth harrow. This was primarily to spread the accumulated droppings, although the sod was considerably furrowed in the process. The practice was discontinued after 1934 since it appeared to destroy a great deal of the hop clover which germinated in the early fall.

Before grazing commenced each spring, all wild onions were removed by digging with a light mattock. Other weeds such as dock, fennel, and certain thistles were cut by hand periodically during the growing season.

Registered Holstein, Jersey, and Guernsey cows were used in the experiments, but an attempt was made to maintain at all times a balance between Holstein and Channel Island breeds in each pasture. The pasture groups were also kept as similar as possible in age, size, and producing ability. All cows were in moderate to heavy production, at least 6 weeks advanced in lactation, yet early enough in lactation to be used throughout the season. Pastures were stocked at a minimum rate of one cow per acre, and animals were added or removed as the condition of the pastures justified. When cows were added they were handled, prior to being placed on test, under the same conditions as the original cows.

Live weight variations for the season were kept within a maximum of 10 percent of the initial weight.

Cows were milked three times per day throughout the experiment. They were weighed on 3 consecutive days at the beginning and end of each season, and weekly or biweekly during the balance of the period. Daily milk yields were recorded, and weekly composite milk samples were tested for butterfat.

Barn feeding was at no time discontinued entirely, although the rate varied frequently. A simple grain mixture containing at least three ingredients was fed at all times. In addition, a small amount of either corn silage or dried beet pulp was fed during the last 2 weeks of each season. The rate of barn feeding was regulated to maintain the milk yield at an average decline of 2.5 percent per week, using the production for the first week on pasture as a basis.

In 1933 the cows were on pasture continuously except during milking hours. In 1934 and 1935 they were kept in dry lots at night and grazed only during the day. They had access to salt, drinking water, and shade in each pasture.

Miscellaneous: Rainfall at Clemson averaged 53.33 inches over a period of 45 years. It is usually evenly distributed throughout the year except during the months of October and November. The average for these 2 months is about 3 inches, and for the other 10 months between 4 and 5 inches. During 1933-35, dry periods occurred during September. Rainfall from April to October, inclusive, during 1933-35 was as follows: 1933, 26.85 inches; 1934, 36.34 inches; 1935, 25.00 inches.

The growing season averages about 220 days. In 1935, however, only 175 days elapsed between killing frosts.

Results: There was an excellent volunteer stand of hop clover (*Trifolium procumbens*) on pastures 1 and 2. It was estimated that pasture 3 at no time during the experiment had more than a 5-percent stand of hop clover, while pasture 4 had a 30- to 40-percent stand throughout the experiment. Pasture 5 had a 5- to 10-percent stand of hop clover and less of white clover. After hop clover matured, in the latter part of May, Bermuda grass predominated in pastures 1 to 4 and carpet grass in pasture 5, and continued to do so for the remainder of the grazing season.

The average percentages of dry matter for the season, based on the analysis of clippings taken every 2 weeks from caged areas $\frac{1}{1500}$ of an acre in size, were as follows: 1934, pasture 1 (Bermuda grass), 31.46 percent, pasture 5 (carpet grass), 26.94 percent; 1935, pasture 1, 31.21 percent, pasture 5, 29.85 percent. The cages were moved to new areas after each clipping. Dry matter is expressed as a percentage of green weight.

Additional results are given in table 25.

TABLE 25.—Summary on a per-acre basis of grazing tests with cattle on permanent Bermuda and on carpet grass pastures, Clemson, S. C., 1933-35

Item	Bermuda grass				Carpet grass, 2-year average, 1934-35
	3-year average, 1933-35			2-year average, 1934-35	
	Pasture 1	Pasture 2	Pasture 3	Pasture 4 (check)	Pasture 5
Soil reaction and treatment:					
Average pH value 1935.....	5.5	6.0	5.8	5.7	5.1
Limestone ¹ tons.....	1.5	1.5	1.5		
16-percent superphosphate annually..... pounds.....	308				237.5
Manure per acre, annually ² tons.....			5		
Grazing data:					
Pasture area..... acres.....	2	2	2	.97	1.38
Calendar days, continuous grazing..... number.....	197	197	192	186	180
Cow-days ³ do.....	342	310	366	226	263
Total gain or loss in live weight..... pounds.....	62	74	81	52	-7
Total 4-percent milk ⁴ do.....	11,434	9,356	11,125	7,405	7,107
Total grain fed..... do.....	3,256	2,849	3,212	2,214	2,748
Total beet pulp fed..... do.....	55	42	67	85	183
Total silage fed..... do.....	539	535	563	303	636

¹ Applied to pastures 1 and 2 in May 1931, and to pasture 3 in November 1932.

² An average of 3 applications: 450 pounds in March 1933; 237.5 pounds in February 1934; and 237.5 pounds in February 1935.

³ Applied in March 1934.

⁴ Applied in January 1933, 1934, and 1935.

⁵ 1,000 pounds average weight.

⁶ Milk converted to 4-percent basis.

ELTING, E. C., LAMASTER, J. P., and MITCHELL, J. H. Permanent pasture studies. S. C. Agr. Expt. Sta. Bul. 308, 54 pp., illus. 1937. See pp. 5-15, 20.

Comparative Improvement in Pasture Through Fertilizing and Liming—Results in Terms of Grass Yields ⁵

ALABAMA

EXPERIMENT A

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn.

Period: 1925-32.

Purpose: To determine the effect of various fertilizer treatments on the yield of upland pasture composed of several grasses and legumes.

Land history: Planted to clean-cultivated crops for at least 30 years prior to 1925. The cropping history is not available because the land was not under control of the experiment station until 1925.

Soil: The soil was typical upland Norfolk sandy loam of very low natural fertility. The land had a 3-percent slope, and there was little erosion.

Procedure and conditions: Twenty-one plots in duplicate were used, each plot being 9 by 12 feet, or $\frac{1}{403}$ of an acre in area. Duplicate sections were separated by 2-foot alleys and unlike sections were separated by 4-foot alleys. Half of the plots were limed at the beginning of the experiment. The experiment was run continuously on the same land.

In the fall of 1925 the plots were seeded with bur-clover at the rate of 27 pounds per acre, and a mixture composed of 1 part each of common and Ladino white clovers and 2 parts of black medic, at the rate of 9 pounds per acre. Inoculated soil was scattered over the area. In March 1926, Dallis grass and common lespedeza were sown on these plots at the rate of 20 pounds per acre, and Korean lespedeza was sown at the rate of 10 pounds per acre. They were covered lightly with a weeder.

In September 1926, another seeding was made with the addition of Carolina clover and hop clover to insure a thick stand of plants. In the spring of 1927 the Dallis grass seeding was repeated at the rate of 12 pounds per acre.

In order to determine whether or not centipede grass could become established in competition with other pasture plants which were already established, six plants of centipede grass were set on each plot in the experiment in July 1928.

Phosphate and potash fertilizers were applied at 5-year intervals (except on one plot where they were applied annually). Two such applications were made, one in the fall of 1925 when the phosphate and potash fertilizers were worked well into the soil when the seedbed was prepared, and the other in January 1931 when these materials were applied as a top dressing. Nitrogenous fertilizers were all applied annually as top dressings.

In order to simulate heavy grazing, the area was harvested with the cutter bar of the lawn mower set as low as practicable, this being considered a more accurate method than actual grazing. The mower had a basket attachment. Plants seeded in the fall of 1925 and in

⁵ See also tables Nos. 14, 15, 17, 21, 22, 23, and 39.

the spring of 1926 were harvested only once in 1926, on August 27. In the spring of 1927 systematic harvesting was begun and continued throughout each season thereafter. The number of harvests each season and the time of harvesting depended largely on seasonal conditions, especially rainfall. In obtaining the green weight the material was weighed immediately after cutting. The amount of dry material was calculated from representative samples taken from check and fertilized plots and dried in an oven at approximately 35 to 40 degrees centigrade for a period of from 3 days to 1 week.

Miscellaneous: The plants were seeded at rates which were higher than would be practical in pastures, because it was desired to establish a sod for the experiment as quickly as possible.

Results: Black medic, bur-, white, Ladino, and Carolina clovers proved susceptible to cold, but hop clover successfully withstood low temperatures.

The stand of lespedeza on these plots was seriously affected by summer droughts, and probably by the competition of hop clover.

Pasture plants were established more quickly and there were fewer weeds on the limed and fertilized plots than on the untreated plots.

Dallis grass responded directly to nitrogen and lime, but particularly to nitrogen. The various clovers showed a direct response to phosphorus and lime. Lespedeza did not respond to lime.

TABLE 26.—*Green and dry weight yields of grasses from upland pasture plots variously fertilized, Auburn, Ala., 1927-32*

Fertilizer treatment ²	6-year average yield of green and dry material per acre, ¹ 1927-32			
	Unlimed		Limed ³	
	Green	Dry	Green	Dry
	Pounds	Pounds	Pounds	Pounds
None (check) ⁴	2,905	902	3,642	1,121
N	5,017	1,466	5,037	1,455
NP	6,584	1,884	7,866	2,187
NPK	6,976	1,967	8,751	2,393
NPK (N as ammonium sulphate)	5,476	1,579	8,237	2,299
NPK (P as basic slag)	7,053	2,007	7,835	2,193
2N, $\frac{1}{2}$ P, $\frac{1}{2}$ K	6,445	1,862	7,830	2,193
P	3,795	1,091	5,000	1,413
PK	4,323	1,254	6,031	1,657
N, $\frac{1}{2}$ P, $\frac{1}{2}$ K (top dressed annually)	6,694	1,912	8,395	2,343
NPK (N in 2 equal applications)	6,289	1,792	8,663	2,360
2N, PK (N in 2 equal applications)	8,645	2,416	11,206	3,093
3N, PK (N in 3 equal applications)	10,366	2,930	13,035	3,597
$\frac{1}{2}$ N, 2 P, 2 K	5,694	1,633	9,548	2,569
$\frac{1}{2}$ N, PK	5,881	1,685	8,136	2,248
2N, 2 P, 2 K	9,553	2,703	12,240	3,329

¹ Each figure is the average of 2 duplicate plots. The grasses and legumes on the plots were mainly clovers, Dallis grass, and centipede grass.

² The treatment (labeled NPK in the table) consisting of the following proportions of NPK was considered the standard: N represents 200 pounds of nitrate of soda per acre annually, P represents 600 pounds of superphosphate every 5 years, and K represents 150 pounds of muriate of potash per acre every 5 years. Treatments on all the other plots were variations of this standard.

³ Limed at the rate of 2 tons of ground limestone per acre in the fall of 1925.

⁴ Average of 6 check plots. Calculated by the Southern Division, A. A. A.

MAYTON, E. L. Permanent pasture studies on upland soils. Ala. Agr. Expt. Sta. Bul. 243, 26 pp., illus. 1935. See pp. 1-3, 18.

MAYTON, E. L., Asst. Agron., Ala. Agr. Expt. Sta., Auburn, Ala. Correspondence of Apr. 30, 1937.

The average seasonal yields of plots for the 1927-32 period were found to correlate very closely with the average distribution of rainfall. An approximate 20-day interval elapsed between rainfall and date of securing grass yields.

Data taken by 10-day periods showed that there was a marked fluctuation in yields throughout the season, but that the yields from all plots regardless of fertilizer treatment followed the same general seasonal distribution.

Additional results are given in table 26.

EXPERIMENT B

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn.

Period: 1926-32.

Purpose: To determine the effects of various fertilizer treatments on the yield of centipede grass.

Land history: The land was planted to clean-cultivated crops for at least 30 years prior to 1926. The cropping history is not available because the land was not under control of the experiment station until 1925.

Soil: The soil was typical upland Norfolk sandy loam of very low natural fertility. The land had a 3-percent slope, and was very slightly eroded.

Procedure and conditions: Ten plots, each 9 by 12 feet, or $\frac{1}{403}$ of an acre in area, were used. Five fertilizer treatments were applied. The experiment was run continuously on the same land.

The plots were sodded to centipede grass in March 1926. The grass was sufficiently established by 1928 to begin harvesting with a lawn mower. Mowing dates varied with the seasonal conditions, particularly rainfall.

Results: Given in table 27.

TABLE 27.—*Effects of various fertilizer treatments on the yield of centipede grass, Auburn, Ala., 1928-32*

Fertilizer treatment ¹	5-year average yield of centipede grass per acre, 1928-32	
	Green	Dry
	Pounds	Pounds
None (check).....	2 969	382
NPK.....	2 2, 022	773
NPKL.....	2 2, 180	835
$\frac{1}{2}$ N, 2 P, 2 K, L.....	1, 877	704
4 N, 2 P, 2 K, L ²	4 6, 288	4 2, 453
2 N, $\frac{1}{2}$ P, $\frac{1}{2}$ K.....	2 2, 848	1, 095

¹ Nitrate of soda, superphosphate, muriate of potash, and ground limestone. Nitrate of soda was applied annually at the rate of 200 pounds per acre, superphosphate every 6 years at the rate of 600 pounds per acre, and muriate of potash every 6 years at the rate of 150 pounds per acre. Ground limestone was applied at the beginning of the experiment in 1926, at the rate of 2 tons per acre.

² Average of 2 duplicate plots.

³ N in 2 equal applications.

⁴ 3-year average. Fertilizer treatment changed in 1929.

MAYTON, E. L. Permanent pasture studies on upland soils. Ala. Agr. Expt. Sta. Bul. 243, 26 pp., illus. 1935. See pp. 3, 4, 23, 25.

MAYTON, E. L., Asst. Agron., Ala. Agr. Expt. Sta., Auburn, Ala. Correspondence of Apr. 30, 1937.

EXPERIMENT C

Conducted by: Alabama Agricultural Experiment Station.

Conducted at: Auburn.

Period: 1925-32.

Purpose: To determine the effects of various fertilizer treatments on yields of Dallis, carpet, and Bermuda grass, planted alone and as a mixture.

Land history: The land had been planted to clean-cultivated crops for at least 30 years prior to 1925. The cropping history is not available because the land was not under control of the experiment station until 1925.

Soil: The soil was typical upland Norfolk sandy loam of very low natural fertility. The land had a 3-percent slope, and was slightly eroded.

Procedure and conditions: Four sections, each with two replications of five plots, were used. Each plot was 9 by 12 feet, or $\frac{1}{403}$ of an acre in area. Sections were separated by 4-foot alleys. The experiment was run continuously on the same land.

The seedbed was well prepared, and in the fall of 1925 the entire area was sown to Southern bur-clover at the rate of 27 pounds per acre, and to a mixture of 1 part of common white clover, 1 part of Ladino clover, and 2 parts of black medic, at the rate of 9 pounds per acre. Inoculated soil was sown with the seed.

In the spring of 1926 this area was divided into four sections. One section was seeded to Dallis grass at the rate of 18 pounds per acre; one to carpet grass at the rate of 9 pounds per acre; one to Bermuda grass at the rate of 9 pounds per acre; and one to all three of the grasses at their respective rates. Common lespedeza at the rate of 15 pounds per acre, and Korean lespedeza at the rate of 10 pounds per acre, were seeded on the entire area along with the different grasses. Very few of the Bermuda grass seeds germinated and, therefore, sod was set in May 1926. In the fall of 1926 the seeding of the previous fall was repeated on all sections. In the spring of 1927, Dallis and carpet grass were again seeded on their respective sections at the rate of 12 pounds per acre. Although hop clover was not seeded in this experiment, some of it scattered from a similar experiment nearby, and by 1929 there was a scattered stand on the Dallis and carpet-grass sections. By the spring of 1930 there was a good stand of hop clover on these two sections and some on the Bermuda grass section. After 1931 there was a thick stand of hop clover on these sections.

Phosphate and potash materials were applied and worked into the soil when the seedbed was prepared in 1925. In January 1931 a second application was made as a top dressing. Nitrogen was applied annually as a top dressing. On some of the plots ground limestone was applied along with the phosphate and potash in the fall of 1925. No lime was applied after that date.

In order to simulate heavy grazing, the grass was harvested with the cutter bar of the lawn mower set as low as practicable. The lawn mower had a basket attachment. The plots were harvested as often as there was sufficient growth. This was considered a more accurate method of determining the results than actual grazing.

Miscellaneous: Bur-, common, and Ladino white clovers, and black medic were winter-killed in January 1928 and practically none of these plants grew after that date. Lespedeza failed to mature enough seed to propagate itself during the two dry seasons of 1930 and 1931, so there were only a few of these plants on any plots in 1932.

Results: Given in table 28.

TABLE 28.—*Green and dry weight yields of Dallis, carpet, and Bermuda grass alone and as a mixture, variously fertilized, Auburn, Ala., 1927-32*¹

Fertilizer treatment ²	6-year average yield per acre, 1927-32 ³							
	Dallis grass		Carpet grass		Bermuda grass		Dallis, carpet, and Bermuda grass mixture	
	Green	Dry	Green	Dry	Green	Dry	Green	Dry
	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
None (check).....	2,568	769	2,216	644	1,313	415	1,662	494
NPK.....	5,854	1,649	5,263	1,439	3,834	1,173	3,926	1,095
NPKL.....	7,697	2,115	6,745	1,784	5,765	1,651	5,174	1,452
$\frac{1}{2}$ N, 2 P, 2 K, L.....	8,142	2,208	7,348	1,917	6,254	1,735	4,680	1,276
2 N, $\frac{1}{2}$ P, $\frac{1}{2}$ K.....	7,479	2,155	5,610	1,607	4,507	1,399	5,488	1,587

¹ Common and Korean lespedeza were sown on all sections.

² Each figure is the average yield of 2 duplicate plots.

³ N represents 200 pounds of nitrate of soda per acre annually, P represents 600 pounds of superphosphate per acre every 5 years, K represents 150 pounds of muriate of potash per acre every 5 years, and L represents 2 tons of ground limestone per acre applied at the beginning of the experiment, in the fall of 1925.

MAYTON, E. L. Permanent pasture studies on upland soils. Ala. Agr. Expt. Sta. Bul. 243, 26 pp., illus. 1935. See pp. 3, 4, 6, 19, 21, 22.

MAYTON, E. L., Asst. Agron., Ala. Agr. Expt. Sta., Auburn, Ala. Correspondence of Apr. 30, 1937.

FLORIDA

EXPERIMENT A

Conducted by: Florida Agricultural Experiment Station, in cooperation with the Division of Forage Crops and Diseases, Bureau of Plant Industry of the United States Department of Agriculture.

Conducted at: Gainesville.

Period: 1930-37.

Purpose: To compare yields from pasture plots fertilized in various ways.

Land history: The land had been cleared probably about 7 years. It was sown to Bahia grass and pastured until 1930.

Soil: The soil was Alachua fine sandy loam. The land was level, uneroded, and well drained by seepage.

Procedure and conditions: In the spring of 1930, 76 plots were laid off at random on an established Bahia grass pasture. Each plot was 19 by 13 feet (or 160 square feet) in size, including a border of 3 feet between plots. There were two or three replications of each plot. Within a short time the Bahia grass gave way entirely to centipede grass. The experiment was conducted on the same land continuously.

One-half of the plots were treated with 600 pounds per acre of hydrated lime every second year. Twenty fertilizer formulas, as listed in the accompanying table, were applied annually at the rate of 600 pounds per acre. All fertilizers were applied on the same

dates in March, or just previous to the rapid growth of the grass, except as noted.

The plots were clipped with a lawn mower each month from March to November, inclusive. Grass samples were oven-dried to convert yields to a moisture free weight.

Miscellaneous: Seasonal conditions were dry during the first 3 years of the experiment.

Results: Given in table 29.

TABLE 29.—Yield of oven-dry Bahia and centipede grass per acre from pasture plots variously fertilized, Gainesville, Fla., 1930-37

Treatment ¹ NPK	7-year average yield of oven-dry Bahia and centipede grass per acre, 1930-37		Treatment ¹ NPK	7-year average yield of oven-dry Bahia and centipede grass per acre, 1930-37	
	Unlimed	Limed		Unlimed	Limed
	Pounds	Pounds		Pounds	Pounds
0-0-0.....	730	567	0-0-6.....	755	608
0-12-6.....	734	852	6-12-0.....	1,321	1,182
4-12-6.....	936	1,275	6-12-6.....	1,488	1,404
6-12-6.....	1,210	1,521	6-12-4.....	1,429	1,299
8-12-6.....	1,450	1,648	6-12-6 ³	1,131	1,283
6-0-6.....	1,058	1,153	6-12-8.....	1,208	1,167
6-8-6.....	1,055	1,127	6-0-0.....	1,638	1,398
6-12-6.....	1,344	1,389	6-12-6.....	1,327	1,091
6-16-6.....	1,088	1,252	6-12-6.....	1,413	1,473
0-12-0.....	809	672	Average.....	1,179	1,176
6-12-6 ²	1,257	1,154			
6-12-6.....	1,384	1,189			

¹ Sodium nitrate, superphosphate, and muriate of potash.

² Phosphate was applied every third year only.

³ One-half of the nitrogen was applied in March and the other half in July.

RITCHIE, G. E., Assoc. Agron., U. S. Dept. Agr. and Fla. Agr. Expt. Sta., and STOKES, W. E., Agron., Fla. Agr. Expt. Sta. Correspondence and [mimeographed], H. H. HUME, Asst. Dir. Res., Fla. Agr. Expt. Sta., Gainesville, Fla., Mar. 18, 1938.

EXPERIMENT B

Conducted by: Florida Agricultural Experiment Station, in cooperation with the Division of Forage Crops and Diseases, Bureau of Plant Industry of the United States Department of Agriculture.

Conducted at: Gainesville.

Period: 1929-32.

Purpose: To determine the effect of closeness of grazing and of nitrogenous fertilizers on the yield and protein content of Bahia, carpet, and centipede grasses. Only the phase dealing with yields is included in this report.

Land history: The plots used in this experiment had been established in 1922 and 1923 in a date-of-planting test, and their treatment had been uniform from the beginning.

Soil: The soil was a fine Norfolk sandy loam.

Procedure and conditions: In the spring of 1929, 18 plots, each 5 by 50 feet, were laid off. Six of the plots were growing a good stand of Bahia grass, six were in carpet grass, and the other six were in centipede grass. The plots were established in 1922 and 1923 and had received uniform treatment.

One-half of each plot was fertilized and the other half was left unfertilized to act as a check.

Two plots of each kind of grass were mowed with a lawn mower at 10-day intervals, two at 20-day intervals, and two at 30-day intervals. Yields were computed on an oven-dry basis from samples taken to the laboratory.

Miscellaneous: The seasonal variation of the different cutting intervals was very slight, the greatest variation occurring in August.

Results: Given in table 30.

TABLE 30.—*Yield of oven-dry grass per acre from fertilized and unfertilized Bahia, carpet, and centipede grass plots cut at various intervals, Gainesville, Fla., 1929-32*

Grass and treatment ¹	4-year average yield of oven-dry grass per acre from plots cut at intervals of—		
	10 days	20 days	30 days
Bahia grass:	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Fertilized.....	1,715	1,609	1,702
Unfertilized.....	1,202	1,070	1,157
Carpet grass:			
Fertilized.....	1,169	1,102	1,193
Unfertilized.....	817	733	660
Centipede grass:			
Fertilized.....	614	603	844
Unfertilized.....	361	243	444

¹ Fertilized areas received ammonium sulphate at the rate of 250 pounds per year, in 5 monthly applications of 50 pounds per acre each.

RITCHEY, G. E., Assoc. Agron. The effect of nitrogen fertilization and frequency of clipping on pasture grass yield and composition. (Unpublished.)

STOKES, W. E., Agron. Correspondence with H. H. Hume, Asst. Dir. Res., Fla. Agr. Expt. Sta., Gainesville, Fla., June 16, 1937.

GEORGIA

EXPERIMENT A

Conducted by: Georgia Coastal Plain Agricultural Experiment Station, in cooperation with the Division of Forage Crops and Diseases, Bureau of Plant Industry, and the Animal Husbandry Division, Bureau of Animal Industry, of the United States Department of Agriculture.

Conducted at: Tifton.

Period: 1931-34.

Purpose: To compare yields of Bermuda grass, carpet grass, and centipede grass on upland soil fertilized with various combinations of a 6-12-6 (NPK) mixture applied (in whole and split applications) at the rate of 600 pounds per acre.

Land history: In cultivated field crops previous to 1931.

Soil: The centipede and Bermuda grass pastures were on fairly moist Tifton sandy loam and the soil of the carpet grass pasture bordered on Norfolk sandy loam. The land sloped gently and there was no erosion.

Procedure and conditions: Plots were $\frac{1}{200}$ acre in size and were duplicated. Plots were separated by 19-inch alleys of sod. Carpet grass was planted from seed; Bermuda grass and centipede grass were set from runners.

Fertilizer was applied each year, all in the spring, unless otherwise indicated in table 31.

Cuttings were made during the grazing season at 3-week intervals with a power lawn mower.

The experiment was conducted continuously on the same land, the treatment of each plot being the same each year.

Miscellaneous: Yields from the Bermuda plots were never pure Bermuda grass. During the spring, weeds, particularly cudweed (*Gnaphalium purpureum*) and blue toadflax (*Linaria canadensis*), caused much trouble on those plots.

The 4-year (1931-34) average rainfall for the period March 1 to October 1 was 32.77 inches, and the average annual rainfall for the 4-year period was 43.24 inches.

Results: Given in table 31.

TABLE 31.—Yields of Bermuda grass, carpet grass, and centipede grass on upland soil fertilized with various combinations of NPK applied at the rate of 600 pounds per acre, Tifton, Ga., 1931-34

Fertilizer formula ² (applied at the rate of 600 pounds per acre)	Dry-weight yield of grasses per acre ¹		
	Bermuda grass, 2-year average, 1931, 1932	Carpet grass, 3-year average, 1931-33	Centipede grass, 4-year average, 1931-34
Phosphoric acid series:	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
6-12-6 (check) ³	1,472	2,018	1,846
6-0-6.....	1,436	1,881	1,774
6-8-6.....	1,453	2,064	1,802
6-16-6.....	1,703	1,810	1,885
Ammonia series:			
6-12-6 (check) ³	1,472	2,018	1,846
0-12-6.....	787	1,369	951
4-12-6.....	1,150	1,661	1,412
8-12-6.....	1,552	2,141	2,286
Potash series:			
6-12-6 (check) ³	1,472	2,018	1,846
6-12-0.....	1,518	1,540	1,750
6-12-4.....	1,609	2,026	1,659
6-12-8.....	1,536	2,228	1,815
Lime and split applications:			
6-12-6 (check) ³	1,472	2,018	1,846
6-12-6, lime ⁴	1,301	2,001	1,614
6-12-6 (split) ⁵	1,596	2,531	1,867
6-12-6 ⁶	1,335	2,164	1,647
Incomplete formulas:			
0-12-0.....	755	1,671	730
6-0-0.....	1,332	1,614	1,639
0-0-6.....	756	1,796	584
0-0-0.....	780	1,493	555

¹ Air dried.

² Ammonia, phosphoric acid, and potash in the order named.

³ Complete fertilizer.

⁴ 2,000 pounds ground limestone every 3 years, 1931 and 1934.

⁵ One-half of the nitrogen was applied in the early spring, the other half in midsummer.

⁶ Nitrogen applied annually, superphosphate and potash every third year.

STEPHENS, J. L. Pastures for the Coastal Plain of Georgia. Through Dr. P. V. Cardon, Prin. Agron. in Chg., Div. Forage Crops and Diseases, Bur. Plant Indus., U. S. Dept. Agr. 1937. (Unpublished manuscript of the Ga. Coastal Plain Bul. 27.)

STEPHENS, J. L., in Chg., Forage crop and pasture project. Correspondence with S. H. Starr, Dir., Ga. Coastal Plain Expt. Sta., Tifton, Ga., July 3, 1937.

EXPERIMENT B

Conducted by: Georgia Coastal Plain Agricultural Experiment Station, in cooperation with the Division of Forage Crops and Diseases, Bureau of Plant Industry, and the Animal Husbandry Division, Bureau of Animal Industry, of the United States Department of Agriculture.

Conducted at: Tifton, Georgia.

Period: 1930-33.

Purpose: To compare the yields of carpet grass on upland soil fertilized at varying rates with a 6-12-6 (NPK), or complete, fertilizer applied all at one time and in split applications.

Land history: The land was in cultivated field crops previous to 1931.

Soil: The soil was fairly moist, bordering on Norfolk sandy loam. The land sloped gently, and there was no erosion.

Procedure and conditions: Plots were $\frac{1}{100}$ acre in size and duplicated, and were separated by 19-inch alleys of sod. Carpet grass seed was broadcast in the spring of 1930, at the rate of 20 pounds per acre. It was not covered. Plots were fertilized with varying amounts of 6-12-6, as indicated in table 32. Yields were determined in pounds of grass per acre. Cuttings were made at 3-week intervals through the summer, beginning about May 6 and ending about November 5. A power lawn mower with a grass catcher was used.

Miscellaneous: The 3-year (1931-33) average rainfall for the period March 1 to October 1 was 31.34 inches, and the average annual rainfall for the 3-year period was 42.56 inches.

Results: When all the fertilizer was applied in the spring, the growth of the grass tended to be greater in the spring and more evenly distributed over the summer.

Additional results are given in table 32.

TABLE 32.—Yields of carpet grass on upland soil fertilized at varying rates in whole and split applications, Tifton, Ga., 1931-33

Fertilizer per acre ¹	Average dry-weight yield of carpet grass per acre			
	1931	1932	1933	3-year average
All fertilizer applied in spring:	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Check (no fertilizer).....	728	1,153	1,755	1,212
200 pounds.....	1,000	1,726	3,034	1,920
400 pounds.....	1,242	2,003	3,275	2,173
600 pounds.....	1,293	2,184	3,316	2,264
800 pounds.....	1,475	2,371	3,105	2,317
1,200 pounds ²	1,621	2,835	2,387	2,281
One-half fertilizer applied in early spring, one-half in midsummer:				
200 pounds.....	881	1,566	2,704	1,717
400 pounds.....	926	1,829	2,916	1,890
600 pounds.....	1,055	2,147	3,381	2,194
800 pounds.....	1,192	2,173	3,111	2,159
All superphosphate and potash applied in spring; nitrogen applied in summer:				
200 pounds.....	647	1,389	2,668	1,568
400 pounds.....	873	1,589	2,706	1,723
600 pounds.....	1,037	2,036	3,002	2,025
800 pounds.....	1,320	2,385	2,579	2,095

¹ 6 percent ammonia, 12 percent phosphoric acid, and 6 percent potash.

² This application was so heavy that it caused, temporarily, considerable burning of the grass.

STEPHENS, J. L. Pastures for the Coastal Plain of Georgia. Through Dr. P. V. Cardon, Prin. Agron. in Chg., Div. Forage Crops and Diseases, Bur. Plant Indus., U. S. Dept. Agr. 1937. (Unpublished manuscript of Ga. Coastal Plain Bul. 27.)

STEPHENS, J. L., in Chg., Forage crop and pasture project. Correspondence with S. H. Starr, Dir., Ga. Coastal Plain Expt. Sta., Tifton, Ga., July 3, 1937.

LOUISIANA

Conducted by: Louisiana Agricultural Experiment Station, Baton Rouge.

Conducted at: Rice Experiment Station, Crowley.

Period: 1932-35.

Purpose: To determine which pasture crops of a permanent nature would afford pasturage or hay for cattle as a supplement to native vegetation, and to determine the best treatment for such pastures. The experiment applied to the general program of cattle raising in connection with rice growing in southwestern Louisiana.

Land history: This had previously been prairie land. During the 5 years prior to the experiment the area was in soybeans harvested for hay.

Soil: The soil was Crowley silt loam, and the land was practically level.

Procedure and conditions: This experiment was conducted on 14 single plots, each 0.38 acre, of which 3 were fertilized and limed, 5 were fertilized only, 3 received lime only, and 3 received neither fertilizer nor lime. The fertilizers were broadcast, and harrowed in, at the rates stated in table 33.

The plots were divided into two general groups, those on which no seed was sown, and those which were seeded to mixtures of grasses and clovers. Four plots were seeded to a mixture of Bermuda grass, white Dutch clover, and common lespedeza; four were seeded to a mixture of Bermuda grass, Dallis grass, lespedeza, Persian clover, and white Dutch clover; the remaining six plots were not seeded. Pasture mixtures were made in the following proportions: Clovers, 10 pounds; lespedeza, 12 pounds; Bermuda grass, 4 pounds; Dallis grass, 10 pounds. Seed was broadcast in January and February of 1932, on well-prepared seedbed. All plots were prepared in the same manner but those not seeded were left to develop a natural growth. The experiment was conducted on the same land continuously.

The plots were not grazed but were mowed about once each month during the growing season. Mowing some years was begun as early as the latter part of March. The yields each year were estimated by clipping five 5-foot squares from each plot. The yield per acre in terms of cured hay was estimated from a certain weight of green matter which was cured.

In 1932 the plots were mowed several times during the growing season. No attempt was made to secure yield records, as the plants had not become well established.

In 1933 the plots were clipped four times, once each month beginning April 17. In 1934 the plots were clipped four times, once in June, July, August, and October. In 1935 the plots were clipped five times, once in April, June, July, August, and October.

Miscellaneous: The seasonal condition during the experiment was normal.

Results: During the first year (1932) white Dutch clover made the best growth. The lespedeza and Bermuda stands were very good. Dallis grass made a fair stand and produced seed of good quality in the late fall. Persian clover made very little growth.

Toward the end of the 1933 season, crabgrass was evident, especially in the areas which had produced heavy crops of white Dutch clover.

In 1934 the Persian clover had practically disappeared.

Bermuda, native, and Dallis grasses increased during the 1935 season. Clovers were not as vigorous as in previous years but they were more widely distributed. Lespedeza was scattered throughout the plots but its growth was very poor.

On the plots which were not seeded, hop clover, lespedeza, white Dutch clover, Bermuda, and other grasses were becoming established by 1935.

Additional results given in table 33.

TABLE 33.—Yields of cured hay from fertilized, unfertilized, limed, and unlimed pasture plots, Crowley, La., 1933–35

Pasture plants	UNFERTILIZED							
	Dry weight yield per acre							
	1933, 4 clippings		1934, 4 clippings		1935, 5 clippings		3-year average	
	Un-limed	Limed	Un-limed	Limed	Un-limed	Limed	Un-limed	Limed
Bermuda grass, white Dutch clover, common lespedeza.....	<i>Tons</i> 4.2	<i>Tons</i> 4.1	<i>Tons</i> 3.5	<i>Tons</i> 3.8	<i>Tons</i> 2.7	<i>Tons</i> 3.5	<i>Tons</i> 3.5	<i>Tons</i> 3.8
Native grasses.....	3.2	2.6	2.8	3.4	3.4	3.2	3.1	3.1
Bermuda grass, Dallis grass, common lespedeza, Persian clover, and white Dutch clover.....	3.7	4.2	2.8	2.1	2.9	3.2	3.1	3.2
FERTILIZED ¹								
Bermuda grass, white Dutch clover, common lespedeza.....	5.4	5.7	3.9	5.3	3.2	4.3	4.2	5.1
Native grasses.....	3.1	3.3	3.7	4.1	3.6	3.2	3.5	3.6
Bermuda grass, Dallis grass, common lespedeza, Persian clover, and white Dutch clover.....	4.3	5.2	4.4	5.1	2.8	3.6	3.7	4.6
Native grasses, sod broken as often as necessary.....	4.0	-----	2.9	-----	2.4	-----	3.1	-----
Native grasses, sod never broken.....	3.6	-----	2.9	-----	2.6	-----	3.1	-----

¹ 600 pounds of 16 percent superphosphate and 200 pounds of muriate of potash per acre, at the time the land was prepared for seeding in January 1932. No additional fertilizer was applied. The following spring, ground limestone was applied in one application, at the rate of 2,000 pounds per acre, to those plots receiving lime.

JENKINS, J. M. Permanent pastures for cattle production in the rice area of Southwestern Louisiana. La. Agr. Expt. Sta. Bul. 276, 7 pp. 1936. See pp. 3-7.

JENKINS, J. M., Supt., Rice Agr. Expt. Sta., Crowley, La. Correspondence of May 18, 1937.

SOUTH CAROLINA

EXPERIMENT A

Conducted by: South Carolina Agricultural Experiment Station, Clemson.

Conducted at: Coast Station, Summerville.

Period: 1932–36.

Purpose: To determine the effect of superphosphate and low grade basic slag, singly and in combination with potash, upon the growth and composition of carpet grass.

Land history: The land had been cleared for about 10 years. It had not been cultivated, but had remained as cut-over woodland.

Soil: The soil was Coxville sandy loam. The land was level, and there was no erosion.

Procedure and conditions: The project consisted of twelve $\frac{1}{20}$ -acre plots, duplicated, upon which fertilizer was applied every third year in varying combinations of low grade basic slag, superphosphate, and muriate of potash. The experiment was run on the same land continuously throughout the experiment.

The pasture land was established in the spring of 1932. After thorough preparation of the land, 10 pounds of carpet grass and 5 pounds of lespedeza, per acre, were broadcast by hand in March.

The first application of fertilizer was made in the spring of 1932. It was broadcast on the surface.

Clippings were made at 2-week intervals during the growing season, with a lawn mower which was equipped with a metal basket.

Miscellaneous: The seasonal condition of the pasture was average.

Results: In the fifth year following the original applications of fertilizer, excellent stands of lespedeza remained on the plots which had received the heavier applications of both superphosphate and basic slag.

Additional results are given in table 34.

TABLE 34.—Yield of carpet grass from pastures variously fertilized, Summerville, S. C., 1934-36

Treatment	Fertilizer per acre	3-year average green weight yield per acre, 1934-36	Treatment	Fertilizer per acre	3-year average green weight yield per acre, 1934-36
	Pounds	Pounds		Pounds	Pounds
None.....	0	3,257	Basic slag.....	1,000	5,028
Basic slag.....	500	4,750	Muriate of potash.....	50	
Do.....	1,000	5,154	16 percent superphosphate.....	300	4,614
16 percent superphosphate.....	300	3,835	Muriate of potash.....	50	
Do.....	600	4,155	16 percent superphosphate.....	600	5,504
Basic slag.....	500	3,747	Muriate of potash.....	50	
Muriate of potash.....	50				

KYZER, E. D., CLYBURN, T. M., and MITCHELL, J. H. The effect of superphosphate, low grade basic slag and potash on the growth and chemical analysis of carpet grass. S. C. Agr. Expt. Sta. Ann. Rept., 144 pp., illus. 1936. See p. 68.

STARKEY, E. V., Head, Anim. Husb. Dept., S. C. Agr. Expt. Sta., Clemson, S. C. Correspondence of Jan. 17, 1938.

EXPERIMENT B

Conducted by: South Carolina Agricultural Experiment Station.

Conducted at: Clemson.

Period: 1929-32.

Purpose: To determine the response of permanent pasture sod to various fertilizer treatments.

Land history: The area had not received treatment of any kind prior to the experiment.

Soil: The soil was a Cecil sandy clay loam, typical of the red-hill area of the Piedmont section of the State. It was classified as "moderately acid." The area was located along the crest of a slight ridge so there was little chance of washing from one plot to another.

Procedure and conditions: In 1929, forty-six $\frac{1}{200}$ -acre plots were laid out on a 20-year-old well established Bermuda sod.

Bermuda grass predominated, but Dallis grass, hop clover, and common lespedeza were also present. There was also a heavy infestation of weeds such as chickweed, red sorrel, narrow leaf plantain, pepper grass (shepherds-purse), and daisy. In all, 31 undesirable weed plants were identified on this area at the beginning of the experiment.

The 46 plots were arranged in 2 series of 23 each, 1 series receiving dolomitic limestone at the rate of 2 tons per acre. Fertilizers were applied to the various plots, a limed and an unlimed plot receiving the same treatment in each case. In all, 15 different combinations were used, the application being at the rate of 600 pounds per acre in each case. The fertilizer treatments were repeated in 1930 and 1931. In order to study the residual effects of the fertilizer treatments, no applications were made in 1932. Limestone was applied in 1929 only. All limestone and fertilizer applications were made on April 3 or 4.

In the spring of 1930, sixteen $\frac{1}{100}$ -acre plots were added to the original experimental area in order to test the effect of the rate of application of various nitrogenous fertilizers and to duplicate some of the original treatments.

In order to study the residual effects of fertilizer treatments, no applications were made in 1932.

No other cultural treatment was given any of the plots.

Clippings were made at 2-week intervals (with the exceptions noted in the table) with a lawn mower fitted with a special basket for collecting the grass.

Miscellaneous: Nitrogen was supplied as sodium nitrate (with the exception of a few plots in the new series which received ammonium sulphate), phosphorus as superphosphate, and potash as muriate of potash.

Rainfall at Clemson averaged 53.33 inches over a period of 45 years. It is usually evenly distributed throughout the year except during the months of October and November; these 2 months have an average of about 3 inches, and the other 10 months have an average of between 4 and 5 inches. Rainfall for 7 months, April through October, from 1929 to 1932 was as follows: 1929, 39.17 inches; 1930, 20.74 inches; 1931, 24.23 inches; 1932, 31.86 inches. Rainfall was evenly distributed in 1929, and unevenly distributed in 1930 and 1931. In 1930 little rain fell after August 1, and in 1931 over 64 percent of the total rainfall for the season fell during the first 6 weeks.

On some of the plots the actual air-dry weights were not obtained, but were estimated on the basis of the percentage of dry weights taken on other plots.

Results: The use of limestone resulted in an increase in clovers and a decrease in weeds. A desirable change in both amount and vigor of clover was observed on the plots receiving phosphorus. The response to sodium nitrate was definite almost immediately after the application was made. Plots fertilized with ammonium sulphate showed greater weed infestation, all the plants lacked vigor, and no trace of clover was present. Changes in composition indicated that

the pasture herbage was less nutritious during the latter part of the growing season.

Additional results are given in table 35.

TABLE 35.—Effect of liming and fertilizer treatments on dry matter yields in pounds per acre as measured by clippings made at 2-week intervals or as designated, Clemson, S. C., 1929–32

Plot No.		1929		1930		1931		1932 (unfertilized)				
		Fertilizer treatments (NPK)	Yield of dry matter per acre	Fertilizer treatments (NPK)	Yield of dry matter per acre	Fertilizer treatments (NPK)	Yield of dry matter per acre	Yield of dry matter per acre				
Limed	Unlimed	Limed	Unlimed	Limed	Unlimed	Limed	Unlimed	Limed	Unlimed			
		Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.			
1	24	6-12-6	2,646	2,454	6-12-6	1,570	1,600	0-0-0	1,409	1,016	2,009	1,803
2	25	0-0-0	2,146	1,816	0-0-0	1,092	988	0-0-0	988	578	1,679	1,244
3	26	6-0-0	2,638	2,609	6-0-0	1,739	1,388	6-0-0	1,428	1,197	1,543	1,498
4	27	0-0-6	2,266	2,059	0-0-6	1,246	1,049	0-0-6	1,230	679	2,140	1,379
5 ¹	28 ¹	6-12-6	2,521	2,608	6-12-6	1,623	1,518	0-0-0	1,749	1,166	2,724	2,020
6	29	0-12-0	2,180	2,240	0-12-0	1,312	1,060	0-12-0	1,665	904	2,572	1,890
7	30	6-12-0	2,302	2,858	6-12-0	1,654	1,603	6-12-0	2,192	1,740	2,034	1,772
8	31	6-12-4	2,670	2,718	6-12-4	1,956	1,788	6-12-4	2,937	1,906	3,263	2,724
9 ²	32 ²	6-12-6	2,801	3,108	6-12-6	2,247	1,880	6-0-0	2,083	1,635	2,490	2,140
10	33	6-12-8	2,478	2,694	6-12-8	2,000	1,754	6-12-8	2,658	1,927	3,151	2,895
11	34	0-12-6	2,262	2,138	0-12-6	1,469	1,181	0-12-6	2,278	1,060	2,440	1,847
12	35	4-12-6	2,476	2,594	4-12-6	1,828	1,483	4-12-6	2,575	1,541	3,294	1,772
13	36	6-12-6	2,700	2,896	0-0-0	1,347	1,139	0-0-0	1,524	803	1,822	1,288
14	37	8-12-6	3,066	2,874	8-12-6	2,134	1,986	8-12-6	2,510	2,043	3,195	2,365
15	38	6-0-6	2,586	2,792	6-0-6	1,791	1,805	6-0-6	1,832	1,428	1,834	1,279
16	39	6-8-6	2,758	3,172	6-8-6	1,993	1,644	6-8-6	2,385	1,841	3,048	1,909
17	40	6-12-6	3,001	2,796	6-12-6	1,899	1,458	6-12-6	2,267	1,698	3,166	1,330
18	41	6-16-6	2,690	2,934	6-16-6	2,173	1,785	6-16-6	2,246	1,747	3,713	1,878
19 ³	42 ³	6-12-6	2,800	2,672	6-12-6	2,191	1,845	6-12-6	2,492	1,622	3,919	2,240
20	43	6-12-6	2,403	2,354	6-0-0	1,486	1,506	6-0-0	1,877	1,045	2,421	1,111
21	44	6-12-6	2,716	2,352	0-0-0	1,241	1,124	6-12-6	2,272	1,277	2,609	1,673
22 ⁴	45 ⁴	9-12-6	2,950	3,238	9-12-6	1,986	1,946	9-12-6	2,708	1,996	3,238	2,421
23 ⁵	46 ⁵	6-12-6	3,470	5,032	6-12-6	2,334	1,806	6-12-6	1,282	1,698	2,956	2,198
	47				0-0-0		1,139	0-0-0		734		1,042
	48				6-12-0		1,707	6-12-0		1,683		1,772
49 ⁶					6-0-0	1,695		6-0-0	1,412		1,304	
	50 ⁴				9-0-0		1,922	9-0-0		1,179		1,345
	51 ⁴				12-0-0		2,169	12-0-0		1,409		1,376
52 ⁶					6-0-0	1,776		6-0-0	1,462		1,756	
	53 ⁶				9-0-0		1,884	9-0-0		994		805
	54 ⁶				12-0-0		2,099	12-0-0		1,273		1,096
	55				6-12-6		2,204	6-12-6		1,630		1,794
	56 ⁶				6-12-6		2,370	6-12-6		1,532		1,516
57					0-0-0	1,657		0-0-0	1,015		1,361	
	58				0-12-0		1,437	0-12-0		966		1,516
	59				0-0-6		1,932	0-0-6		733		1,176
	60				6-0-6		2,245	6-0-6		1,456		1,508
	61 ⁴				9-12-6		2,873	9-12-6		2,009		1,956
	62 ⁶				9-12-6		2,821	9-12-6		1,763		1,638

¹ Clipped weekly in 1929 and 1930.

² Clipped every 3 weeks in 1929 and 1930.

³ Nitrogen, made in 2 applications.

⁴ Nitrogen, made in 3 applications.

⁵ Only 1 clipping at end of season.

⁶ Ammonium sulfate used.

ELTING, E. C., LAMASTER, J. P., and MITCHELL, J. H. Permanent pasture studies. S. C. Agr. Expt Sta. Bul. 308, 54 pp., illus. 1937. See pp. 6, 7, 30, 32, 33, 39, 41, 42, 48, 50.

EXPERIMENT C

Conducted by: South Carolina Agricultural Experiment Station, Clemson.

Conducted at: Coast Station, Summerville.

Period: 1929–32.

Purpose: To determine the effect of lime and fertilizers on the growth and composition of carpet grass. (The phase showing composition is not given in this digest.)

Land history: The land had been cleared 16 years prior to this experiment and in 1921 it was converted into permanent pasture, at which time carpet grass was sown broadcast by hand.

Soil: The soil was Coxville sandy loam. The land was level and there was no erosion.

Procedure and conditions: In the spring of 1929, fifteen $\frac{1}{10}$ -acre plots were laid out on old carpet grass sod in which a little common lespedeza was present. Only 5 of the plots are discussed here as results for the other 10 are not available. These 5 received various combinations of nitrate of soda, superphosphate, and muriate of potash, broadcast on the surface, at the rate of 600 pounds per acre; and one-half of each plot was limed at the rate of 2 tons of ground limestone per acre. These applications were made each spring.

Beginning in 1931 clippings were made at 2-week intervals with a lawn mower which had a basket attachment. The experiment was run on the same land, the treatment of each plot being repeated each year.

Results: Given in table 36.

TABLE 36.—Yield of carpet grass per acre from pasture plots treated with various combinations of lime and fertilizer, Summerville, S. C., 1931, 1932

Fertilizer treatment (NPK) ¹	2-year average yield of carpet grass per acre	
	Limed ²	Unlimed
	Pounds	Pounds
0-0-0.....	1,288	1,354
0-0-6.....	1,351	1,463
6-0-0.....	1,906	1,841
0-12-0.....	1,419	1,545
6-12-6.....	2,109	2,395

¹ 600 pounds per acre, annually.

² 2 tons per acre, annually.

Pastures. S. C. Agr. Expt. Sta. Ann. Rept., 122 pp., illus. 1929. See p. 89.

KYZER, E. D., and CLYBURN, T. M. Effect of lime and fertilizers on the growth and composition of carpet grass. S. C. Agr. Expt. Sta. Ann. Rept., 189 pp., illus. 1933. See p. 122.

STARKEY, L. V., Head, Anim. Husb. Dept., S. C. Agr. Expt. Sta., Clemson, S. C. Correspondence of Jan. 17, 1938.

Comparative Improvement in Pasture Through Fertilizing and Liming—Results in Terms of Thickness of Stand ⁶

TENNESSEE

Conducted by: Tennessee Agricultural Experiment Station, Knoxville.

Conducted at: Middle Tennessee Station, Columbia.

Period: 1928–34.

⁶ See also tables Nos. 12 and 17.

Purpose: To determine the possibility of eradicating broomsedge by mowing, pasturing, and fertilizing.

Land history: The land had been cleared about 75 or 100 years. It had been in a rotation of corn, wheat, and grass and/or clover until about 5 years previous to this experiment, when it was seeded to mixed pasture grasses and a little clover.

Soil: The soil was Maury silt loam, a brown loam rich in phosphate. The land had a 3-percent slope and had lost about 9 inches of soil.

Procedure and conditions: In 1928 the land, well established in broomsedge, and having hop clover, wild onions, and a little common lespedeza, was leased from a neighbor.

The broomsedge was mowed and raked off. The land was disked lightly, harrowed to make a seedbed, and sown in early March 1928 to 14 pounds of bluegrass and 2 pounds of white clover per acre. Conditions were favorable and a good stand was established.

Part of the land was divided into three $\frac{1}{8}$ -acre plots, which were fertilized as indicated in table 37. The rest of the land, or six-eighths of an acre, was used as a check. One-half of each fertilized plot and of the check area was limed. The time of mowing and the method of pasturing were the same on the entire experimental area, and the same land was used each year of the experiment.

A mower was used on the experimental plots and the surrounding area often enough to prevent broomsedge from forming seed. Three mowings were required the first year, but two were usually enough, and when combined with pasturing sometimes one was sufficient.

In 1929 pasturing was begun with grade Hereford yearling steers, averaging 525 pounds each, the mower being used to take care of the broomsedge that was left. The steers had been wintered well and then pastured on other lands to accustom them to fresh pasture. They were placed on the experimental area in April or May after the grass had made a good start. The area was grazed continuously with two steers until the grass was grazed down. When the grass had grown in again the procedure was repeated. The cattle did not receive supplementary feed. Shade was provided for the cattle.

Miscellaneous: 1928 and 1929 were excellent grass years, 1930 and 1931 were very dry, 1932 was fair, 1933 was a good pasture year, and 1934 was a very poor pasture year.

The plots were too small to make satisfactory grazing tests, so the entire area was grazed as a unit.

Results: Per acre gains made by steers were as follows: 1929, 274 pounds; 1930, 180 pounds; 1931, a poor pasture season, and as a result of close grazing the record of gains is not reliable; 1932, 165 pounds; 1933, 337 pounds; and 1934, 68 pounds.

At the present time (1938) broomsedge is practically absent, especially on the fertilized areas, in spite of the fact that broomsedge seed has been spread over the land.

Additional results are given in table 37.

TABLE 37.—*Effect of mowing, pasturing, and fertilizing, on the percentage of broomsedge and of bluegrass and clovers, on the basis of 100 percent for a full stand, Columbia, Tenn., 1928, 1930, 1932, and 1934*¹

Year ²	Percentage of—							
	Broomsedge on—				Bluegrass and clovers on—			
	Check plot	Manured plot ³	Nitrate of soda plot ⁴	Sulphate of ammonia plot ⁵	Check plot	Manured plot ³	Nitrate of soda plot ⁴	Sulphate of ammonia plot ⁵
1928-----	90	90	90	90	10	10	10	10
1930-----	54	⁶ 38	38	⁶ 42	40	⁶ 62	⁶ 62	⁶ 58
1932-----	15	(⁷)	(⁷)	(⁷)	52	90	85	90
1934-----	15	0.03	0.08	0.2	60	95	95	95

¹ Half of each plot, including the check, was limed at the rate of 2 tons of ground limestone per acre.² Records were made only during the years listed.³ 6 tons per acre at the beginning of the experiment, and every third year thereafter.⁴ 200 pounds annually, about the middle of March.⁵ 150 pounds annually.⁶ Estimated by the Southern Division, A. A. A., on the basis of information received through correspondence from the Tennessee Agricultural Experiment Station.⁷ Less than 5 percent.

NEEL, L. R. Control of broomsedge. Tenn. Agr. Expt. Sta. Cir. 57, [4] pp. 1936. See pp. 2, 3.

NEEL, L. R. Studies in sedge-grass control. Assoc. Sou. Agr. Workers, Proc. 37th Ann. Conv. (1936), 208 pp. 1937. See pp. 18, 19.

NEEL, L. R., Supt., Middle Tenn. Sta., Columbia, Tenn. Correspondence of Feb. 9, 1938.

Comparative Methods of Management—Frequent and Infrequent Cuttings⁷

FLORIDA

Conducted by: Florida Agricultural Experiment Station.

Conducted at: Gainesville.

Period: 1926–28.

Purpose: To determine the effect of frequent cutting on the vegetative aftergrowth and protein content of Bahia grass. The phase presented here shows the yield of dry matter only.

Land history: The area had previously been in native forest and was cleared 1 year before this experiment was begun.

Procedure and conditions: On August 6, 1926, Bahia grass was transplanted in 37 rows, each 86 feet long. The rows were 3 feet apart, and the Bahia plants were spaced 18 inches apart in the rows. The area was kept free of weeds during the remainder of the growing season. The plants became well established and produced considerable growth, but no cuttings were made.

In the early spring of 1927, 25 rows were divided into 5 plots of 5 rows each. The remaining 12 rows were located between and adjacent to these plots, and received the same treatment as the plots they were near. Yields are given on a basis of 8 rows, or 2,064 square feet. Samples were taken from the adjacent rows and the center row of each plot. A lawn mower was used. No fertilizer was used. The experiment was conducted on the same land continuously.

During the growing season of 1927 and 1928 the grass on plots 1 and 3 was cut frequently, i. e., whenever it attained a height of 4 or

⁷ See also tables Nos. 15, 30, 35, and 41.

5 inches. The grass on plots 2 and 4 was cut at maturity. Later in the season the aftergrowth was cut. The grass on plot 5 was cut at maturity.

Miscellaneous: A dry period occurred in the spring of 1927.

Results: On the plots which were cut frequently a complete sod was formed between the rows before the end of the growing season of 1927. On those which were cut at the seed stage of the plants, the vacant spaces between the rows were only partially covered.

Additional results are given in table 38.

TABLE 38.—*Yield of dry matter per acre from Bahia plots cut frequently and infrequently, Gainesville, Fla., 1927 and 1928*¹

Date and frequency of cutting	Yield of dry matter per acre		
	1927	1928	2-year average
Cut frequently:²	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
April.....	217		³ 217
May.....	20	103	62
June.....	627	879	753
July.....	916	1,436	1,176
August.....	465	1,626	1,046
September.....	762	775	768
October.....	113	253	183
November.....		149	³ 149
Total or average.....	3,120	⁴ 5,221	4,170
Cut in seed stage and aftergrowth:⁵			
September.....	3,385	3,415	3,400
October.....		44	³ 44
November.....	1,342	87	714
Total or average.....	4,727	3,546	4,136

¹ Tabular results are given in Bulletin 219 in terms of grams per 2,064 square feet. The dry-weight yields have been converted to pounds per acre by using the factor 21.5—a product of 2 factors, 453.59 (grams per pound) and 0.04738 (the fraction of an acre contained in 2,064 square feet).

² Cut 15 times in 1927, and 13 times in 1928.

³ 1 year only.

⁴ Total dry weight per plot in 1928 calculated to be 112,258.98 grams. Given as 113,259.8 grams in Bulletin 219.

⁵ Cut twice in 1927, and 4 times in 1928.

LEUKEL, W. A., and COLEMAN, J. M. Growth behavior and maintenance of organic foods in Bahia grass. Fla. Agr. Expt. Sta. Bul. 219, 56 pp., illus. 1930. See pp. 9-11, 15, 21.

LEUKEL, W. A., and COLEMAN, J. M. Correspondence with H. H. Hume, Asst. Dir. Res., Fla. Agr. Expt. Sta., Gainesville, Fla., June 15, 1937.

OKLAHOMA

Conducted by: Oklahoma Agricultural Experiment Station.

Conducted at: Stillwater.

Period: 1934. (From a 6-year experiment, 1930-35.)

Purpose: To determine the effect of frequency of clipping on the air-dry hay yield of native pasture grasses, on their root weight, and on root volume. The digest presented here does not include root weight and volume.

Land history: The area had been grazed by horses at first, and by dairy cattle later.

Soil: The soil was Kirkland loam, brown in color, the land being situated on what is known as the Red Plains. The plots were located on an eastern exposure of sloping hillside having a drop of 5 feet in every 100. Erosion was slight. The subsoil was rather compact, brownish red, and sandy, beginning at depths varying from 8 to 15 inches.

Procedure and conditions: Ninety-six plots, each 8 by 12 feet in size, were fenced off from a native pasture area in 1930. The digest presented here deals with 10 of these plots, 6 unfertilized and 4 fertilized. There were four replications of all the plots. The fertilized plots were located below the unfertilized plots on the hillside.

The six plots receiving no fertilizer treatment were clipped as follows: Plot No. B-3, clipped twice a year on July 20 and November 2; No. C-4, clipped three times annually, May 18, July 20, and September 21; No. D-8, clipped five times annually, May 18, June 29, August 10, September 21, and November 2; No. E-6, clipped eight times annually, beginning May 25 and at 21-day intervals until October 19; No. F-9 clipped nine times, May 18 to November 2; No. F-6, clipped ten times annually, April 27 to November 2.

Four plots which, in 1930 only, received an application of fertilizer or manure and fertilizer, were clipped as follows (see table 39 for kind of treatment): Plots No. H-3 and H-4, clipped the same as No. B-3 above; Nos. G-3 and G-4, clipped the same as D-8 above.

In order of dominance, the local unmolested grasses along the alleys of the plots and an adjoining roadside strip of identical origin were as follows: Little bluestem, switchgrass, Indian grass, big bluestem, blue grama, side-oats grama, needlegrasses, prairie three-awn, prairie dropseed, and *Paspalum*s.

The surrounding region of native grass is commonly referred to as bluestem or tall-grass country.

Clippings were secured with a hand sickle and oven-dried. To the oven-dry weights 15 percent was added uniformly for "air-dry" moisture. The resultant "air-dry" figures were considered similar to farmers' hay production weights.

In the following table, the air-dry weights are given for the fifth year of this experiment in order to show comparative production.

Results: Given in table 39.

TABLE 39.—Yield of air-dry hay from native pasture plots clipped at varying intervals, Stillwater, Okla., 1934¹

Plot number and treatment	Clippings per year	Yield air-dry hay per acre
	<i>Number</i>	<i>Tons</i>
Untreated plots:		
B-3.....	2	1.02
C-4.....	3	1.36
D-8.....	5	1.22
E-6.....	8	.82
F-9.....	9	.92
F-6.....	10	.92
Fertilized plots: ²		
H-3, 10 tons stable manure and 400 pounds superphosphate per acre.....	2	1.65
G-3, 10 tons stable manure and 400 pounds superphosphate per acre.....	5	1.12
H-4, 100 pounds sodium nitrate per acre.....	2	1.38
G-4, 100 pounds sodium nitrate per acre.....	5	1.26
Average: ³		
Untreated plots.....	6.2	1.04
Fertilized plots.....	3.5	1.35

¹ Experiment run 6 years, 1930-35. Fifth year comparative results given here.

² Fertilized in 1930 only.

³ Calculated by the Southern Division, A. A. A.

GERNERT, W. B. Native grass behavior as affected by periodic clipping. Jour. Amer. Soc. Agron., vol. 28, No. 6, pp. 423-490, illus. 1936. See pp. 447-450.

GERNERT, W. B., Assoc. Prof. Agron., Okla. Agr. Expt. Sta., Stillwater, Okla. Correspondence of July 28, 1937.

Comparative Methods of Management—Various Methods of Grazing

LOUISIANA

EXPERIMENT A

Conducted by: Louisiana Agricultural Experiment Station.

Conducted at: Baton Rouge.

Period: 1930-35.

Purpose: To determine (1) the effect on cattle gains and on pasture herbage of grazing (a) cattle exclusively, (b) sheep exclusively, and (c) cattle and sheep together; (2) the effect on cattle gains of improving native pasture by disking, and sowing Italian ryegrass and clovers; and (3) the parasitic infestation of calves and lambs grown under the three systems (a, b, and c) of management. The phase dealing with parasitic infestation is not discussed in this report of the experiment.

Land history: The area had been in row crops at one time and rice at one time, but for some years prior to this experiment it had grown up in water sedges and water grass with a small amount of white Dutch clover and Bermuda grass. The sedge, grass, and clover land had been grazed.

Procedure and conditions: In the fall of 1930 a 22.8-acre black-land river-front pasture was fenced and drained. The area was grazed in 1931, and in the fall of that year it was divided into two equal lots of 11.4 acres each. Both lots were mowed. Lot 1 received no further treatment, but lot 2 was disked and seeded with 6 pounds of white Dutch clover, 9 pounds of redtop, and 9 pounds of Italian ryegrass per acre. A small amount of Bermuda grass was scattered on areas on which none was growing. Both lots, throughout the 5 years of the experiment, were grazed by grade Hereford, Brahman, and Shorthorn cattle.

In 1933 a similar experiment was begun with sheep. An unimproved pasture (lot 4) and an improved pasture (lot 5, disked, and seeded to Italian ryegrass and white Dutch clover) were grazed by native ewes and lambs sired by merino rams. An additional pasture (lot 3) was grazed by cows, calves, ewes, and lambs. This lot was added to the experiment because observations had shown that pastures grazed only by cattle had good stands of clover but were weedy, while adjoining sheep pastures had very little clover, no weeds, and a heavy growth of coarse grass which the sheep could not eat. A sixth lot, of cows and calves, was grazed on the university cattle pasture to be used as a check against lot 3 in the study of parasitic infestations. Results from this lot (6) are not reported here.

During the 1934 and 1935 grazing seasons forage studies were made from protected and from unprotected plots cut at three seasons of the year (spring, summer, and fall) and from protected plots cut during the fall. These studies are reported elsewhere as an individual experiment. (See table 41.)

Miscellaneous: The improved pastures were disked and seeded only once.

Results: Given in table 40.

TABLE 40.—Gains made by cattle, sheep, and by cattle and sheep together on improved and native unimproved blackland river-front pasture, Baton Rouge, La., 1931-35

CATTLE										
Item	Lots 1 and 2 (undivided)	Lot 1, unimproved (mowed)				Lot 2, improved (mowed, disked, and seeded)				
		1931	1932	1933	1934	1935	1932	1933	1934	1935
Area.....acres.....	22.8	11.4	11.2	11.2	11.2	11.4	11.2	11.2	11.2	11.2
Days of grazing.....number.....	148	194	190	214	216	194	209	214	216	216
Cows.....do.....	13.2	9.8	² 11.7	6.0	6.0	13.5	² 14.0	8.0	8.0	8.0
Initial weight.....pounds.....				720	725			742	717	
Gain per head.....do.....	³ 120	³ 204	³ 143	123	155	³ 196	³ 213	136	209	8
Calves.....number.....				6	6			8	8	
Initial weight.....pounds.....				109	123			107	120	
Gain per head.....do.....				275	275			273	299	

CATTLE AND SHEEP TOGETHER

Item	Lot 3, unimproved					
	Cattle			Sheep		
	1933	1934	1935	1933	1934	1935
Area.....acres.....	17	17	17	17	17	17
Days of grazing ¹number.....	149	214	216	184	214	216
Cows or ewes.....do.....	12	10	10	⁴ 16	12	12
Initial weight.....pounds.....	806	754	788	97	70	72
Gain per head.....do.....	45	160	188	-2.7	27	20
Calves or lambs.....number.....	12	10	10	12	10	7
Initial weight.....pounds.....	198	101	125	33	15	23
Gain per head.....do.....	217	314	353	30	50	38

SHEEP

Item	Lot 4, unimproved			Lot 5, improved (disked and seeded)		
	1933	1934	1935	1933	1934	1935
Area.....acres.....	7.8	7.8	7.8	11.0	11.0	11.0
Days of grazing ¹number.....	184	214	216	184	214	216
Ewes.....do.....	⁵ 16	6	6	⁶ 33	15	⁷ 18
Initial weight.....pounds.....	79	73	71	80	76	69
Gain per head.....do.....	-3.4	2.0	-3.3	0.1	4.0	1.2
Lambs.....number.....	11	5	⁸ 6	⁹ 23	14	¹⁰ 9
Initial weight.....pounds.....	38	13	23	55	45	49
Gain per head.....do.....	14	31	19	23	30	25

¹ Grazing period in days for 1931, 1932, and 1933 computed from the following grazing periods: 1931, Apr. 17 to Sept. 12; 1932, Mar. 19 to Sept. 29; 1933, (a) cattle, lot 1, Mar. 30 to Oct. 6; lot 2, Mar. 30 to Oct. 25; lot 3, Apr. 19 to Sept. 15; (b) sheep, lots 3, 4, and 5, Apr. 12 to Oct. 13. In 1934 the grazing period for all lots was from Mar. 26 to Oct. 25; in 1935 it was from Mar. 28 to Oct. 30. Days of grazing for 1931, 1932, and 1933 calculated by the Southern Division, A. A. A.

² Yearling heifers.

³ Calculated by the Southern Division.

⁴ 16 to 19 ewes. Ewes were added on Sept. 15.

⁵ 16 to 20 ewes. Ewes were added on Sept. 15.

⁶ 33 to 39 ewes. Ewes were added on Sept. 15.

⁷ 2 ewes died.

⁸ 2 lambs died.

⁹ 1 lamb died, Aug. 10.

¹⁰ 8 lambs died.

SNELL, M. G. Grazing and parasitical studies with cattle and sheep. La. Agr. Expt. Sta. Bul. 279, 38 pp., illus. 1936. See pp. 3, 5, 6, 8-11, 27.

BRAY, C. I. Beef cattle production in Louisiana. La. Agr. Expt. Sta. Bul. 244, 21 pp., illus. See pp. 17, 18.

DOWELL, C. T., Dir., La. Agr. Expt. Sta., Baton Rouge, La. Correspondence of May 13, 1937.

SNELL, M. G., Assoc. Prof., Anim. Indus. Dept., La. Agr. Expt. Sta., Baton Rouge, La. Correspondence of Sept. 9, 1937.

EXPERIMENT B

Conducted by: Louisiana Agricultural Experiment Station.

Conducted at: Baton Rouge.

Period: 1934, 1935.

Purpose: To study the forage on (1) unprotected (grazed) plots cut at three seasons of the year, (2) protected (ungrazed) plots cut at three seasons of the year, and (3) protected (ungrazed) plots cut in the fall.

Procedure and conditions: The experiment was conducted on five lots located on river-front pasture. Lots, 1, 3, and 4 were native pastures grazed by cattle, cattle and sheep, and sheep, respectively; lots 2 and 5 were improved pastures grazed by cattle and by sheep, respectively.

During the 1934 and 1935 seasons three plots (one of each type to be studied) were located in different areas of each of the five lots. There were three replications, or a total of nine 1-meter square plots in each lot. On the plots which were cut three times, the cuttings were made in the spring, summer, and fall. The fall-cut area was cut by hand in November.

The unprotected plots were grazed by grade Hereford, Shorthorn, and Brahman cattle of various ages, by native ewes, and by lambs sired by merino rams.

Miscellaneous: In studying the progressive effect of grazing different classes of animals as shown on the unprotected plots it should be kept in mind that the area had been grazed by the cattle several years before the beginning of the forage experiment and that the difference in forages may have been due, in part, to grazing previous to the time of the forage studies.

Results: Given in table 41.

TABLE 41.—Percentage of various pasture plants on unprotected and protected grass plots cut at 3 seasons and on protected plots cut in the fall, Baton Rouge, La., 1934, 1935

Pasture plants ¹	UNPROTECTED (AVERAGE OF 3 CUTTINGS)									
	Percentage of various plants									
	1934					1935				
	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
Dallis grass	Pct. 10.8	Pct. 7.1	Pct. 58.4	Pct. 37.4	Pct. 31.7	Pct. 3.4	Pct. 6.9	Pct. 36.1	Pct. 2.0	Pct. 37.7
Bermuda grass	53.9	64.0	13.2	34.0	38.6	27.6	47.7	14.2	10.4	20.0
Broomsedge	.1			3.6	1.6	1.1			68.8	19.9
White Dutch clover	.5	.3	3.8	.2	4.6	.2	2.7	6.0		1.5
Weeds	34.8	27.4	24.5	24.5	23.2	17.1	9.2	.8	.2	2.0

¹ Lots 1, 2, and 3 were grazed rather closely, while lots 4 and 5 had a heavy growth of coarse grass which the sheep could not eat. All 5 lots were mowed at the end of the grazing period but only lots 4 and 5 had enough material to rake.

TABLE 41.—Percentage of various pasture plants on unprotected and protected grass plots cut at 3 seasons and on protected plots cut in the fall, Baton Rouge, La., 1934, 1935—Continued

PROTECTED (AVERAGE OF 3 CUTTINGS)											
Dallis grass.....	26.1	14.8	77.0	47.2	42.8	43.8	22.6	84.3	20.9	40.1	
Bermuda grass.....	31.4	37.6	1.9	15.6	20.0	12.5	14.7	.8	2.8	8.2	
Broomsedge.....	3.4	-----	-----	13.1	3.5	3.8	-----	.1	52.1	3.2	
White Dutch clover.....	.6	-----	10.4	.03	15.7	.1	13.6	.3	3.0	21.0	
Weeds.....	.7	4.6	.01	-----	.1	27.0	23.4	7.4	7.6	8.2	

PROTECTED (9 MONTHS GROWTH)											
Dallis grass.....	23.9	29.4	45.2	1.2	5.0	5.3	2.7	34.0	5.3	40.0	
Bermuda grass.....	25.8	22.4	.1	3.7	33.1	1.6	2.0	5.0	.8	12.5	
Broomsedge.....	3.5	-----	1.5	79.6	8.9	4.2	-----	5.8	37.3	.4	
White Dutch clover.....	-----	.4	-----	-----	.01	-----	-----	-----	-----	-----	
Weeds.....	42.2	30.1	37.2	15.1	34.6	65.0	23.4	47.0	30.5	16.0	

SNELL, M. G. Grazing and parasitical studies with cattle and sheep. La. Agr. Expt. Sta. Bul. 279, 38 pp., illus. 1936. See pp. 27-34.

SNELL, M. G., Assoc. Prof. Anim. Indus. Dept. Correspondence with C. T. Dowell, Dir., La. Agr. Expt. Sta., Baton Rouge, La., May 13, 1937.

OKLAHOMA

Conducted by: Oklahoma Agricultural Experiment Station, Stillwater, in cooperation with the animal husbandry and agronomy departments of the Oklahoma Agricultural and Mechanical College and the 101 Ranch of Marland, Okla.

Conducted at: 101 Ranch, Marland.

Period: 1927-35. (Results for 1935 not available.)

Purpose: To determine (1) the amount of beef that can be produced with a combined system of deferred and rotated grazing compared with the amount of beef produced with a system of continuous grazing; (2) the effect of a combined system of deferred and rotated grazing on increasing the desirable forage and decreasing the amount of weeds produced; and (3) a practical system of grazing based on the physiological requirements of the native grasses. The only phase presented in this digest is a comparison of the amount of beef produced under a combined system of deferred and rotated grazing with the amount produced under a system of continuous grazing.

Land history: The land was a native pasture range which had never been cleared. During the 5 years prior to this experiment it had been grazed continuously.

Soil: The soil was Kirkland and Bates. The land had a 10-percent slope and the degree of erosion was slight.

Procedure and conditions: The 520-acre area used was composed mostly of big bluestem (*Andropogon furcatus*), little bluestem (*Andropogon scoparius*), blue grama (*Bouteloua gracilis*), and buffalo grass (*Bulbilis dactyloides*), in the order named. One half, or 260 acres, was used for continuous grazing, and the other half was further divided into three rotation pastures of 86.6 acres each. One of the three rotation pastures was left idle each season and allowed to mature to seed, the three being rotated so as to give each of them 1 year

of rest out of every 3 years. The cattle were alternated between the remaining two rotation pastures at approximately 30-day intervals. The experiment was conducted on the same land each year. A few trees in each pasture provided the only shelter and there was a surface pond for water.

A total of 999 animals was grazed during the 8 years of the experiment which are reported here. Hereford yearling steers were used every year except in 1931, when young cows were substituted. The cattle were weighed at 30-day intervals, when they were being shifted from one rotation pasture to another.

Miscellaneous: The pasture was fairly representative of the grazing lands of north central Oklahoma and was much better than the average farm pasture. The seasons during the experiment were dry.

Results: The cattle graded fair at the end of the experiment.

There was a slightly lower percentage of weeds in the rotation pastures than in the continuous grazing pasture, and no noticeable change in the nature of vegetation in any of the pastures.

Additional results are given in table 42.

TABLE 42.—*Gains made by cattle grazed continuously and by cattle grazed under a system combining deferred and rotated grazing, Marland, Okla., 1927-34*

Year	Days grazed	Head per lot		Average initial weight per head		Average total gain per head	
		Continu-ous	Deferred and ro-tated	Continu-ous	Deferred and ro-tated	Continu-ous	Deferred and ro-tated
	Number	Number	Number	Pounds	Pounds	Pounds	Pounds
1927-----	152	¹ 65	¹ 65	684	684	260	214
1928-----	142	65	65	496	489	254	264
1929-----	114	80	80	430	447	187	148
1930-----	146	55	54	418	377	204	224
1931-----	104	50	50	722	728	190	169
1932-----	128	² 63	² 67	462	460	213	182
1933-----	130	65	65	553	549	163	142
1934-----	161	55	55	375	378	237	192
8-year average-----	134	62	63	³ 514	³ 511	³ 212	³ 191

¹ 52 head per lot started May 10, 1927; 13 head per lot added July 30, 1927. Days of grazing season (152) are corrected for 65 head.

² 65 head were placed in each pasture at first but 2 head changed within a few days and remained so throughout the season.

³ Weighted average.

BLIZZARD, W. L., HAWKINS, L. E., and KILTZ, B. F. Management of native pastures. Okla. Agr. Expt. Sta. Rept. (1934-36), 191 pp., illus. 1936. See pp. 154, 155.

BLIZZARD, W. L., HAWKINS, L. E., and KILTZ, B. F. Management of native pastures. Okla. Agr. Expt. Sta. Rept. (1932-34), 314 pp., illus. 1934. See pp. 106-108.

BLIZZARD, W. L., HAWKINS, L. E., and KILTZ, B. F. Management of native pastures. Okla. Agr. Expt. Sta. Rept. (1930-32), 397 pp., illus. 1932. See pp. 72-76.

GERNERT, W. B., Assoc. Prof. Agron., Okla. Agr. Expt. Sta., Stillwater, Okla. Correspondence of July 28, 1937.

